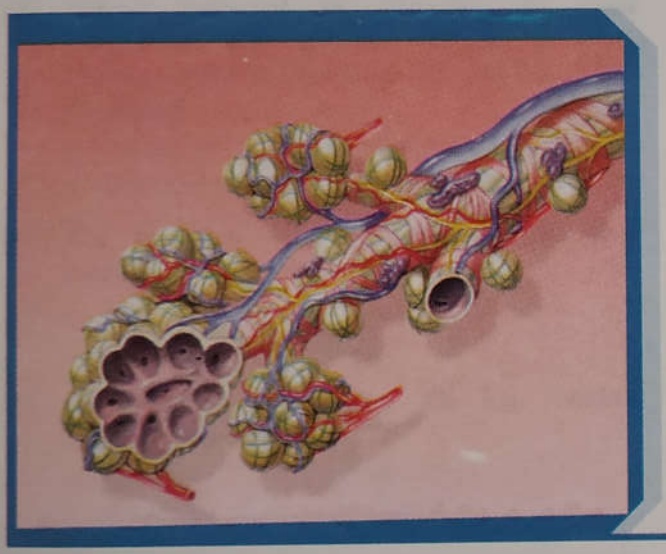


PHYSIOLOGY

General Physiology – Questions

Q1. D_2O (Deuterium oxide) is used to measure volume of:

a. Blood
b. Total body water
c. Extracellular fluid
d. Intracellular fluid

Q2. Potassium is maximum in

a. Cell
b. Plasma
c. Interstitium
d. Bone

Q3. When solvent is moving in one direction, the solvent tends to drag along some molecules of solute. This is called

a. Filtration
b. Osmosis
c. Donnan effect
d. Solvent drag

Q4. For sodium – potassium pump the coupling ratio is –

a. 1:1
b. 2:3
c. 3:2
d. 1:4

Q5. In a man weighing 70 kg, water content of body is

a. 20-30 L
b. 30-40 L
c. 40-45 L
d. 50-60 L

Q6. Osmolality of plasma in a normal adult (in m Osm/L) is –

a. 250-270
b. 270-290
c. 300-310
d. 310-330

Q7. Oncotic pressure of plasma is mainly due to

a. albumin
b. Preabumin
c. Electrolytes
d. Fibrinogen

Q8. Not true regarding Na^+/K^+ pump is –

a. Pumps Na^+ against a gradient
b. 5 Na^+ exchange for $2K^+$
c. Increase in intracellular Na^+ increases the activity of the pump
d. Hypocalcemia inhibits the pump

Q9. The following is an example of 'Regulated pathway'-

a. Constitutive exocytosis
b. Receptor mediated endocytosis
c. Constitutive endocytosis
d. Non -constitutive exocytosis

Q10. True about facilitated diffusion are A/E-

a. Occur in direction of concentration gradient
b. Does not require energy
c. Occur in direction opposite to electrical gradient
d. Facilitated by charge of molecule

Q11. Which of the following statements is true regarding basal metabolic rate

a. Increased in starvation
b. It is not influenced by hormonal changes
c. It is not affected by dietary changes
d. Decreased by 50% in starvation

Q12. The cell junctions allowing exchange of cytoplasmic molecules between the two cells are called –

a. Gap junctions
b. Tight junctions
c. Focal junctions
d. Zonula occludens

Q13. Most accurate measurement of extracellular fluid volume (ECF) can be done by using-

a. Sucrose
b. Mannitol
c. Inulin
d. Aminopyrine

Q14. Energy producing enzymes are located in –

a. Rough endoplasmic reticulum
b. Ribosomes
c. Golgi apparatus
d. Mitochondria

1. b	2. a	3. d	4. c	5. c	6. b	7. c	8. b	9. d	10. c
11. d	12. a	13. c	14. d						

Q15. Clathrins used in –

a. Receptor mediated endocytosis
b. Exocytosis
c. Cell to cell adhesion
d. Plasma membrane

Q16. All of the following transport process follow 'saturation kinetics' except-

a. Facilitated diffusion
b. Na^+ -$Ca2^+$ exchanger
c. Simple diffusion
d. Na+ coupled active transport

Q17. Which one of the following gases is used for cell signaling-

a. CO_2 b. O_2
c. NO d. N_2

Q18. Transcytosis occurs in –

a. Epithelial cells of intestine
b. Neuroglia
c. Neuron
d. Axolemma

Q19. Glucose is co-transported with Na^+ ions. This is a type of –

a. Secondary active transport
b. Primary active transport
c. Facilitated diffusion
d. Simple diffusion

Q20. Regarding transport of substances through the cell membrane, all are true except-

a. Glucose is transported via facilitated diffusion
b. Active transport is an energy driven process
c. Facilitated diffusion requires energy
d. Facilitated diffusion requires carrier protein

Q21. According to Fick's law, transport across a membrane is increased with increase in –

a. Concentration gradient
b. Temperature
c. Size of molecule
d. Weight of the molecule

Q22. All of the following are used to measure ECF volume, except-

a. Sucrose b. Sodium chloride
c. Inulin d. Heavy water

Q23. Osmotic pressure of 1 mol of ideal solute relative to pure water is –

a. 6.5 atm b. 22.4 atm
c. 4 atm d. 2 atm

Q24. Which of the following transport processes is passive-

a. Co-transport of Na^+ ion and a molecule into cell
b. Exchange of K^+ ion outside the cell for Na^+ ion inside the cell
c. Flow of H_2O through cell membrane by osmosis
d. Uptake of molecules into cell by endocytosis

Q25. Basal metabolic rate depends most closely on –

a. Lean body mass
b. Body mass index
c. Obesity
d. Body surface area

Q26. Decreased basal metabolic rate is seen in –

a. Obesity b. Hyperthyroidism
c. Feeding d. Exercise

Q27. In addition to kidney counter current multiplier system is present in

a. Crypts of gastric submucosa
b. Bone
c. Muscles
d. Skin

Q28. Exercise is also prescribed as an adjuvant treatment for depression. Most probably is acts by-

a. Increasing pulse pressure
b. Improving hemodynamics
c. Raising endorphin levels
d. Inducing good sleep

Q29. Specific dynamic action is maximum for –

a. Protein b. Carbohydrate
c. Fats d. Vitamins

15. a	16. c	17. c	18. a	19. a	20. c	21. a	22. d	23. b	24. c
25. a	26. a	27. d	28. c	29. a					

Q30. Respiratory Quotient of fat, protein and carbohydrate are .... respectively?

a. 0.70, 0.80, 1.0
b. 0.80, 0.70, 1.0
c. 0.8, 1.0, 0.7
d. 1.0, 0.8, 0.7

Q31. BMR is high in the following except-

a. Newborns
b. Athletes
c. Females as compared to males
d. Cold climate

Q32. Specific dynamic action is-

a. 6% for proteins
b. 30% for lipids
c. Energy expended on consumption of foods
d. Due to gastrointestinal factors

Q33. BMR is dependent on-

a. Body weight
b. Surface area
c. Amount of adipose tissue
d. Amount of lean body mass

Q34. BMR increase in all except-

a. Low environmental temperature
b. Anxiety
c. Thyrotoxicosis
d. Sleep

Q35. All are examples of negative feedback except-

a. Clotting of the blood
b. Regulation of blood pressure
c. Regulation of blood glucose
d. Regulation of carbon monoxide

Q36. The process by which there is decrease in the total area of cell membrane is

a. Mitosis b. Exocytosis
c. Endocytosis d. None of the above

Q37. Osmolarity is –

a. Number of osmoles of solute per kg of solvent
b. Number of osmoles of solute per liter of solvent
c. Moles per Kg of solvent
d. Moles per Litre of solvent

Q38. Clathrin mediates-

a. Receptor mediated endocytosis
b. Exocytosis
c. Pericytosis
d. Mesocytosis

Q39. The motility of cell is due to which protein-

a. Motilin b. Tubulin
c. Laminin d. Tactilin

Q40. All are true about sodium potassium pump except-

a. Needs ATP
b. Is inactive at 4° C
c. Is ELECTROGENIC
d. Needed for generation of action potential

Q41. A substance on I.V injection was found to be distributed through thirty percent of body water. It probably-

a. Did not pass freely through blood capillaries
b. Was distuributed evenly throughtout body water
c. Did not enter cells of body
d. Was exculuded from CSF

Q42. The ionic channels in excitable membrane are lined by-

a. Cephalins b. Proteins
c. Lipids d. Carbohydrates

Q43. A solution contains 1 gram- mole of magnesium sulfate per liter. Assuming full ionization of this compound, calculate the osmotic pressure of the solution (1 mosmole/ litre concentration is equivalent to 19.3mm. Hg osmotic pressure)-

a. 19.3 mm Hg b. 38.6 mm Hg
c. 19,300mmhg d. 38,600mmHg
e. 57,900mmHg

Q44. The emeiocytosis or reverse pinocytosis requires which ion-

a. Na^+ b. K^+
c. Ca^{++} d. Mg^{++}

30. a	31. c,a	32. c	33. d	34. d	35. a	36. b	37. b	38. a	39. b
40. d	41. c	42. b	43. c	44. c					

Q45. Sodium channels are specifically blocked by-

a. Nifedipine
b. Tetradotoxin
c. Tetra Ethyl lead
d. Choline

Q46. D_2O (deuterium oxide) is used to measure volume of –

a. Blood
b. Total body water
c. Extacellular fluid
d. Intracellular fluid

Q47. Potassium is maximum in-

a. Cells b. Plasma
c. Interstitium d. Bone

Q48. On Weight basis, the membrane contains protein and lipid in the ratio of–

a. 1:2 b. 1:1
c. 2:1 d. 4:1

Q49. The non-ionic diffusion in body is seen in-

a. Gut b. Kidneys
c. Both d. None

Q50. For sodium- Potasium pump the coupling ratio is

a. 1:1 b. 2:3
c. 3:2 d. 1:4

Q51. In a man weighing 70 Kg. water content of body is-

a. 20-30L b. 30-40L
c. 40-50L d. 50-60L

Q52. Osmolality of plasma in a normal adult (in m OSm/L) is-

a. 250-270 b. 270-290
c. 300-310 d. 310-330

Q53. Oncotic pressure of plasma is due to-

a. Albumin b. Prebumin
c. Electrolytes d. Fibrinogen

Q54. Calmodulin activates-

a. Muscle phosphorylase
b. Protein Kinase
c. 2,3 DPG
d. Glucokinase

Q55. In isometric exercise the following changes occurs except-

a. Increase in muscle tone
b. Staircase phenomenon
c. Summation of contractions
d. Relaxation heat

Q56. Most accurate measurement of extracellular fluid volume (ECF) can be done by using-

a. Sucrose b. Mannitol
c. Inulin d. Aminopyrine

Q57. True about K^+ homeostasis in humans is-

a. Most of the K^+ are intracellular
b. Most of the K^+ are extra cellular
c. An essential electrolyte for different organ function
d. Actively secreted in the distal tubule
e. It maintains the Na^+ K^+ ATPase activity

Q58. All of the following transport process follow "saturation kinetics" except-

a. Facilitated diffusion
b. Na^+ - CA^{2+} exchanger
c. Simple diffusion
d. Na^+ coupled active transport

Q59. Regarding transport of substances through the cell membrane, all are true except-

a. Glucose is transported via facilitated diffusion
b. Active transport is an energy driven process
c. Facilitated diffusion requires energy
d. Facilitated diffusion requires a carrier protein

Q60. As per the Fick's law, flux of geomembraneis increased by increase in-

a. Concentration gradient across the membrane
b. Temperature
c. Size of molecule
d. Weight
e. Area

45. b	46. b	47. a	48. b	49. c	50. c	51. c	52. b	53. a	54. b
55. d	56. c	57. a,c,d	58. c	59. c	60. a,e				

Q61. All of the following are used to measure ECF volume except-

a. Sucrose
b. Radioactive Sodium
c. Inulin
d. Heavy Water

Q62. Most permeable to pure phospholipid bilayer:

a. Oxygen b. Na
b. CI d. Water

Q63. True regarding Na^+ ion:

a. Responsible for Donnan effect
b. Responsible for resting membrane potential
c. Responsible for depolarization
d. Does not help other ions in transport

Q64. Major cation in ECF -

a. Na b. K
c. PO_4^{-2} d. Mg

Q65. Transfer of solutes between cells via

a. Desmosomes
b. Gap junctions
c. Fascia adherens
d. Zonulaoccludens

Q66. The parameter that remain unchanged the advancement of age:

a. Hematocrit
b. Creatinine clearance
c. FEV
d. Heart rate response to stress

Q67. Total body water differences between male and female is not seen at the age of:

a. Above 60 years
b. 40-60 years
c. 10-18 years
d. 18-25 years

Q68. Maximum contribution to plasma osmolarity is by:

a. Urea b. Glucose
c. Sodium d. Albumin

Q69. The term "Milieu interior" was given by:

a. Knut Schmidt-Nielsen
b. George Bartholomew
c. Claude Bernard
d. Walter Cannon

Q70. Transcellular fluid is seen in:

a. Body cavities lined by epithelium
b. Intracellularly
c. Intercellularly
d. None of them

Q71. Energy is required in :

a. Diffusion
b. Osmosis
c. Active transport
d. None

Q72. All of the following are true about potassium except :

a. Mostly concentrated inside the cells
b. Leaves the cell in the presence of insulin
c. Ingestion of acetazolamide results in loss of potassium in urine
d. Plasma concentration increases at time of metabolic acidosis

Q73. Homeostatis is body 's mechanisms :

a. Meant to stop bleeding
b. For maintenance of nearly constant conditions in the internal environment
c. For maintenance of body posture
d. For maintenance of body blood pressure

Q74. Most important extracellular buffer :

a. Phosphate b. Plasma proteins
c. Ammonia d. Bicarbonates

Q75. Peripheral cell membrane protein are :

a. Pump
b. Channel
c. Adhesion molecules
d. Enzyme receptors

Q76. All are seen more in ECF except:

a. Na^+ b. CI^-
c. Mg^{++} d. HCO_3^-

Q77. Carbonic anhydrase activity found in all except :

a. Brain b. Kidney
c. RBC d. Plasma

61. d	62. a	63. c	64. a	65. b	66. a	67. c	68. c	69. c	70. a
71. c	72. b	73. b	74. b	75. c	76. c	77. d			

Q78. Which of the following methods is not used for measurement of body fluid volumes:

a. Antipyrine for total body water
b. Insulin for extracellular fluid
c. Evans blue for plasma volume
d. ^{125}I- albumin for blood volume

Q79. Albumin exerting high oncotic pressure because :

a. High molecular weight and low concentration
b. Low molecular weight and high concentration
c. High molecular weight and high concentration
d. Low molecular weight low concentration

Q80. Isotope used to measure RBC volume is :

a. Cr^{51}
b. H_3
c. D_2O
d. I^{135}

Q81. Which of the following transport processes is a passive mechanism?

a. Sodium out of the brain cells
b. Calcium into the sarcoplasmic reticulum
c. Hydrogen into the gastric lumen
d. Glucose into the adipocytes

Q82. Which of the following characteristics of a water- insoluble substance is most important in determining its diffusibility across cell membranes?

a. Molecular weight
b. Diameter
c. Electrical charge
d. Lipid solubility

78. d	79. b	80. a	81. d	82. d

General Physiology – Explanations

1. b) Total body water

(Ref- Guyton Physiology 13th edition- page 49)- D_2O is used for measurement of total body water.

2. a) Cell

(Ref -Clinical methods: The History, Physical and Laboratory Examinations: 3rd edition: Chapter 195)- Maximum K+ is present in cell (ICF= 98%) primarily in skin, muscle, subcutaneous tissue and RBCs.

3. d) Solvent drag

(Ref- Guyton Physiology 13th edition- page 342)- As water moves across the tight junctions by osmosis, it can also carry with it some of the solutes, a process referred to as solvent drag.

4. c) 3:2

(Ref- Ganong's Review of Medical Physiology 24th edition- page 43)

5. c) 40-45 L

(Ref- Ganong's Review of Medical Physiology 25th edition- page 4)

TBW= 60% of body weight- so 60% x 70 = 42L.

6. b) 270-290

(Ref- Guyton Physiology 13th edition- page 309).

7. a) albumin

(Ref- Guyton Physiology 13th edition- page 196)- Thus, about 80 percent of the total colloid osmotic pressure of the plasma results from the albumin, 20 percent from the globulins, and almost none from fibrinogen.

8. b) 5 Na^+ exchange for 2K^+

(Ref- Ganong's Review of Medical Physiology 24th edition- page 47)- It is an electrogenic pump in that it moves three positive charges out of the cell for each two that it moves in, and it is therefore said to have a coupling ratio of 3:2. I

9. d) Non -constitutive exocytosis

(Ref- Ganong's Review of Medical Physiology 24th edition- page 43)-

In the **nonconstitutive pathway,** proteins from the Golgi apparatus initially enter secretory granules, where processing of prohormones to the mature hormones occurs before exocytosis. The other pathway, the **constitutive pathway,** involves the prompt transport of proteins to the cell membrane in vesicles, with little or no processing or storage. The nonconstitutive pathway is sometimes called the **regulated pathway,** but this term is misleading because the output of proteins by the constitutive pathway is also regulated.

10. c) Occur in direction opposite to electrical gradient

(Ref- Guyton Physiology 13th edition- page 35).

11 d) Decreased by 50% in starvation

(Ref- Guyton Physiology 13th edition- page 907)- BMR is

12. a) Gap junctions

(Ref- Ganong's Review of Medical Physiology 25th edition- page 41)- The pore diameter in the channel is estimated between 0.8 and 1.4 nm, which permits the passage of ions, sugars, amino acids, and other solutes with molecular weights up to about 1000 Da.

13. c) Inulin

(Ref- Guyton Physiology 13th edition- page 49)- inulin is best for ECF measurement.

14. d) Mitochondria

(Ref- Ganong's Review of Medical Physiology 25th edition- page 11).

15. a) Receptor mediated endocytosis

(Ref- Ganong's Review of Medical Physiology 25th edition- page 46)-

Explanation- Clathrin-mediated endocytosis is responsible for the internalization of many receptors and the ligands bound to them—including, for example, nerve growth factor (NGF) and low-density lipoproteins. It also plays a major role in synaptic function

16. c) Simple diffusion

(Ref- Guyton Physiology 13th edition- page 35)

Explanation- Carrier dependent transport follow saturation kinetics. Simple diffusion does not require carrier protein.

17. c) NO

(Ref- Ganong's Review of Medical Physiology 25th edition- figure 32-9 – page 595).

18. a) Epithelial cells of intestine

(Ref- Ganong's Review of Medical Physiology 25th edition- page 52)

Explanation- Vesicles are present in the cytoplasm of endothelial cells, and tagged protein molecules injected into the bloodstream have been found in the vesicles and in the interstitium. This indicates that small amounts of protein are transported out of capillaries across endothelial cells by endocytosis on the capillary side followed by exocytosis on the interstitial side of the cells. The transport mechanism makes use of coated vesicles that appear to be coated with caveolin and is called **transcytosis, vesicular transport,** or **cytopempesis.**

19. a) Secondary active transport

(Ref- Ganong's Review of Medical Physiology 24th edition- page 48).

Explanation- In many situations the active transport of Na+ is coupled to the transport of other substances (secondary active transport).

20. c) Facilitated diffusion requires energy

(Ref- Guyton Physiology 13th edition- page 35).

21. a) Concentration gradient

(Ref- Ganong's Review of Medical Physiology 24th edition- page 4).

22. d) Heavy water

(Ref- Guyton Physiology 13th edition- page 49)- D_2O is used for measurement of total body water.

23. b) 22.4 atm

(Ref- Guyton Physiology 13th edition- page 51)-.

Explanation- At 37degree Celsius- a concentration of 1 osmole per liter will cause 19300 mmHg osmotic pressure in the solution equivalent to 19300/ 760= 22.4 atm.

24. c) Flow of H_2O through cell membrane by osmosis

(Ref- Ganong's Review of Medical Physiology 25th edition- page 6).

25. a) Lean body mass

(Ref- Guyton Physiology 13th edition- page 907).

Explanation- BMR accounts for 50-70% of daily energy expenditure in most sedentary persons.

26. a) Obesity

(Ref- Guyton Physiology 13th edition- page 907).

Explanation- Variations in BMR among different persons are related mainly to the differences in amount of skeletal muscle and body size.

27. d) Skin

(Ref- Ganong's Review of Medical Physiology 25th edition- page 685).

Explanation- There are other examples of the operation of countercurrent exchangers in animals. One is the heat exchange between the arteries and venae comitantes of the limbs. To a minor degree in humans, but to a major degree in mammals living in cold water, heat is transferred from the arterial blood flowing into the limbs to the adjacent veins draining blood back into the body, making the tips of the limbs cold while conserving body heat.

28. c) Raising endorphin levels

(Ref. Prim Care Companion Journal of Clin Psychiatry 2004;6: 104-111)

Explanation- Proposed mechanisms for the exercise depression relationship:

Endorphin Hypothesis: exercise releases β endorphins, which reduced symptoms.

Monoamine Hypothesis: exercise leads to increase in availability of brain neurotransmitters (e.g., serotonin, dopamine and nor epinephrine) that are diminished with depression.

Distraction Hypothesis: distraction from worries and depressing thoughts.

Thermogenic Hypothesis: rise in core body temperature following exercise is responsible for the reduction in symptoms of depression.

29. a) Protein

(Ref- Ganong's Review of Medical Physiology 25th edition- page 488).

Explanation- The SDA of a food is the obligatory energy expenditure that occurs during its assimilation into the body. It takes 30 kcal to assimilate the amount of protein sufficient to raise the metabolic rate 100 kcal; 6 kcal to assimilate a similar amount of carbohydrate; and 5 kcal to assimilate a similar amount of fat. The cause of the SDA, which may last up to 6 h, is uncertain.

30. a) 0.70, 0.80, 1.0

(Ref- Ganong's Review of Medical Physiology 25th edition- page 487).

Explanation- The RQ of carbohydrate is 1.00, and that of fat is about 0.70. Determining the RQ of protein in the body is a complex process, but an average value of 0.82 has been calculated.

31 c. Females as compared to males

(Ref- Guyton's Physiology 13th edition- page 908).

Explanation- Much of the decline in BMR with increasing age is probably related to loss of muscle mass and replacement of muscle with adipose tissue, which has a lower rate of metabolism. Likewise, slightly lower BMRs in women, compared with men, are due partly to the lower percentage of muscle mass and higher percentage of adipose tissue in women.

32. c) Energy expended on consumption of foods

(Ref- Ganong's Review of Medical Physiology 25th edition- page 488).

Explanation- The SDA of a food is the obligatory energy expenditure that occurs during its assimilation into the body. It takes 30 kcal to assimilate the amount of protein sufficient to raise the metabolic rate 100 kcal; 6 kcal to assimilate a similar amount of carbohydrate; and 5 kcal to assimilate a similar amount of fat. The cause of the SDA, which may last up to 6 h, is uncertain

33. d) Amount of lean body mass

(Ref- Guyton Physiology 13th edition- page 907).

Explanation- Variations in BMR among different persons are related mainly to differences in the amount of skeletal muscle and body size.

34. d) Sleep

(Ref- Guyton Physiology 13th edition- page 908).

Explanation- **Sleep Decreases Metabolic Rate.** The metabolic rate decreases 10 to 15 percent below normal during sleep. This decrease is due to two principal factors: (1) decreased tone of the skeletal musculature during sleep and (2) decreased activity of the central nervous system.

35. a) Clotting of the blood

(Ref- Ganong's Review of Medical Physiology 25th edition- page 497).

Explanation- Inactive plasma kallikrein **(prekallikrein)** is converted to the active form, kallikrein, by active factor XII, the factor that initiates the intrinsic blood clotting cascade. Kallikrein also activates factor XII in a positive feedback loop, and high-molecular-weight kininogen has a factor XII–activating action (see Figure 31–12).

36. b) Exocytosis

(Ref- Ganong's Review of Medical Physiology 25th edition- page 46).

Explanation- It is apparent that exocytosis adds to the total amount

of membrane surrounding the cell, and if membrane were not removed elsewhere at an equivalent rate, the cell would enlarge. However, removal of cell membrane occurs by endocytosis, and such exocytosis–endocytosis coupling maintains the surface area of the cell at its normal size.

37. b) Number of osmoles of solute per liter of solvent

(Ref- Ganong's Review of Medical Physiology 25th edition- page 7).

Explanation- Osmolarity is the number of osmoles per liter of solvent, whereas osmolality is the number of osmoles per kilogram of solvent.

38. a) Receptor mediated endocytosis

(Ref- Ganong's Review of Medical Physiology 25th edition- page 46).

Explanation- Clathrin -mediated endocytosis is responsible for the internalization of many receptors and the ligands bound to them including, for example, nerve growth factor and low density lipoproteins.

39. b) Tubulin

(Ref- Ganong's Review of Medical Physiology 25th edition- page 36,38).

Explanation- Tubulins are structural subunits of microtubules which regulate cell motility.

Motilin is a 22aa polypeptide hormone in humans which regulates intestinal motility.

Laminin is an extracellular matrix protein which regulates cell development and growth.

Tactilin- no such term in medical didctionary.

40. d) Needed for generation of action potential

(Ref- Ganong's Review of Medical Physiology 25th edition- page 49, 50).

Explanation- the pumpis responsible for generation of resting membrane potential not the action potential.

41. c) Did not enter cells of body

(Ref- Ganong's Review of Medical Physiology 25th edition- page 4).

Explanation- Total body water is 60% of body weight, if dye is distributed in only 30% of water that means it has not entered cells.

42. b) Proteins

(Ref- Guyton Physiology 13th edition- page 13).

Explanation- Integral proteins provide structural components of membrane like channels (or pores), carrier proteins (pumps), receptor (enzyme receptor) etc.

43. e) 57,900mmHg

1 gram – mole of $MgSO_4^{2-}$ contains 2 osmoles of Mg2+ ions and I osmole of SO_4^{2} ions – so total number of osmoles are 3 , osmotic pressure of such a solution will be- 19.3 x 1000x 3= 57,900 mmHg.

44. c) Ca^{++}

(Ref- Ganong's Review of Medical Physiology 25th edition- page 46).

Explanation- Reverse pinocytosis is an exocytosis process that requires Ca2+.

45. b) Tetradotoxin

(Ref- Ganong's Review of Medical Physiology 25th edition- page 49,50).

46. b) Total body water

(Ref- Guyton Physiology 13th edition- page 49).

47. a) Cells

(Ref- Ganong's Review of Medical Physiology 25th edition- page 4).

48. b) 1:1

(Ref- Guyton Physiology 12th edition, page 14, 13th edition- page 9).

Explanation- The cell membrane contains protein and lipids in the ratio of 55:45, this is approximately 1:1.

49. c) Both

(Ref- Ganong's Review of Medical Physiology 25th edition- page 9).

Explanation- Some weak acids and bases are quite soluble in cell membranes in the undissociated form, whereas they cannot cross membranes in the charged (ie, dissociated) form. Consequently, if

molecules of the undissociated substance diffuse from one side of the membrane to the other and then dissociate, there is appreciable net movement of the undissociated substance from one side of the membrane to the other. This phenomenon is called nonionic diffusion. It is regularly seen along the epithelial membrane of kidney and git.

50. c) 3:2

(Ref- Ganong's Review of Medical Physiology 25th edition- page 51).

51. c) 40 - 50L

Explanation- TBW is 60% of body weight of the person. So, answer is 60/100 x 70= 42 Kg.

52. b) 270-290

(Ref- Ganong's Review of Medical Physiology 25th edition- page 8).

Explanation- All but about 20 of the 290 mOsm in each liter of normal plasma are contributed by Na+ and its accompanying anions, principally Cl– and HCO3–.

53. a) Albumin

(Ref- Guyton Physiology 13th edition- page 196).

Explanation- Thus, about 80 percent of the total colloid osmotic pressure of the plasma results from the albumin, 20 percent from the globulins, and almost none from fibrinogen. Therefore, from the point of view of capillary and tissue fluid dynamics, it is mainly albumin that is important.

54. b) Protein kinase

(Ref- Ganong's Review of Medical Physiology 25th edition- Table 2-4, page 54).

55. d) Relaxation heat

Explanation- since in isometric exercise – length of muscle remains same so muscle does nit shorten and thereby relaxation heat is not seen.

56. c) Inulin

(Ref - Guyton Physiology 13th edition- page 49).

Explanation- Inulin is best for ECF measurement.

57. a) Most of the K^+ are intracellular

c) An essential electrolyte for different organ function

d) Actively secreted in the distal tubule

(Ref: Clinical Methods: The History, Physical and Laboratory Examination. 3rd edition. Chapter 195).

Explanation- Total body K+ is 55mEq/kg body weight. Of this amount 98% is in intracellular compartment. Some active secretion of K+ takes place in the most distal part of the distal convoluted tubules but potassium excretion is primarily a passive process. Na+- K+ - ATP ase pump maintains the distribution of K+ ion.

58. c) Simple diffusion

(Ref- Guyton Physiology 13th edition- page 35).

Explanation- Carrier dependent transport follows saturation kinetics. Simple diffusion does not require carrier protein.

59. c) Facilitated diffusion requires energy

(Ref- Guyton Physiology 13th edition- page 35).

e. Area

60. a) Concentration gradient across the membrane
e) Area

A>E - (Ref- Ganong's Review of Medical Physiology 25th edition-page 6).

61. d) Heavy Water

(Ref- Guyton Physiology 13th edition- Table 25.3, page 309).

62. a) Oxygen

(Ref: Alberts- Molecular Biology of the Cell, 5th edition, page 652).

Explanation- Relative permeability of different molecules: Hydrophobic molecules (CO2, O2, N2, Steroid hormones) >>> small uncharged polar molecules (H2O, Urea, Glycerol)>>> large uncharged polar molecules (glucose, sucrose) >>> Ions (Na+, K+, Cl-).

63. c) Responsible for depolarization

(Ref- Ganong's Review of Medical Physiology 25th edition-page 8).

Explanation- Donnan effect is distribution of all permeable ions due to presence of non permeable ions. K+ is responsible for RMP.

64. a) Na

(Ref- Ganong's Review of Medical Physiology 25th edition-page 5).

Explanation- In ECF major cation is Na+ and anion is Cl-. In ICF major cation is K+ and anion is phosphate.

65. b) Gap junctions

(Ref- Ganong's Review of Medical Physiology 25th edition-page 39).

Explanation- The diameter of the channel is about 0.8 to 1.4 nm which allows ions, sugars , amino acids, and other solutes with molecular weight upto about 1000.

66. a) Hematocrit

(Ref- Guyton Physiology 13th edition-page 324).

Explanation- Creatinine clearance decreases with aging as functional nephrons decrease with aging. FEV also decreases with aging. Heart rate response to stress slows or it takes longer for the pulse to increase and longer for the pulse to return to normal. Hematocrit remains unchanged.

67. c) 10-18 years

(Ref: Fluid and Electrolyte Balance By Norma M. Metheny).

Explanation- Difference is not seen upto puberty.

68. c) Sodium

(Ref- Guyton Physiology 13th edition-Table 25.3, page 311).

Explanation- Note that about 80 percent of the total osmolarity of the interstitial fluid and plasma is due to sodium and chloride ions, whereas for intracellular fluid, almost half the osmolarity is due to potassium ions and the remainder is divided among many other intracellular substances.

69. c) Claude Bernard

(Ref- Guyton Physiology 13th edition-page 3).

Explanation- Thus, all cells live in essentially the same environment—the extracellular fluid.

For this reason, the extracellular fluid is also called the *internal environment* of the body, or the *milieu intérieur*, a term introduced more than 150 years ago by the great 19th-century French physiologist Claude Bernard (1813-1878).

70. a) Body cavities lined by epithelium

(Ref- Guyton Physiology 13th edition-page 306).

Explanation- There is another small compartment of fluid that is referred to as *transcellular fluid.* This compartment includes fluid in the synovial, peritoneal, pericardial, and intraocular spaces, as well as the cerebrospinal fluid; it is usually considered to be a specialized type of extracellular fluid, although in some cases its composition may differ markedly from that of the plasma or interstitial fluid. All the transcellular fluids together constitute about 1 to 2 liters.

71. c) Active transport

(Ref. Guyton's Physiology 13th edition, pp 55).

72. b) Leaves the cell in the presence of insulin

(Ref- Guyton Physiology 13th edition-page 385).

Explanation- Insulin is important for increasing cell potassium uptake after a meal. In people who have insulin deficiency owing to diabetes mellitus, the rise in plasma potassium concentration after eating a meal is much greater than normal.

73. b) For maintenance of nearly constant conditions in the internal environment

(Ref- Guyton Physiology 13th edition-page 4).

Explanation- In 1929 the American physiologist Walter Cannon (1871–1945) coined the term homeostasis to describe the maintenance of nearly constant conditions in the internal environment.

74. b) Plasma proteins

(Ref- Ganong's Review of Medical Physiology 25th edition-page 643).

Explanation- Acid and base shifts in the blood are largely controlled by three main buffers in blood: (1) proteins, (2) hemoglobin, and (3) the carbonic acid-bicarbonate system. Plasma **proteins** are effective buffers because both their free carboxyl and their free amino groups dissociate.

75. c) Adhesion molecules

(Ref- Guyton Physiology 13th edition-page13).

Explanation- Integral proteins provide structural component of membrane like channels (or pores), carrier proteins(pumps), receptors (enzyme receptor), etc.. Peripheral protein molecules are often attached to the integral proteins.

76. c) Mg^{++}

(Ref- Ganong's Review of Medical Physiology 25th edition-page 5).

77. d) Plasma

(Ref- Ganong's Review of Medical Physiology 25th edition-page 644).

Explanation- There is no carbonic anhydrase in plasma, but there is an abundant supply in red blood cells, spatially confining and controlling the reaction.

78. d) ^{125}I- albumin for blood volume

(Ref- Guyton Physiology 13th edition-page 309).

Explanation- I^{125} is used for plasma volume not blood volume.

79. b) Low molecular weight and high concentration

(Ref- Guyton Physiology 13th edition-page 196).

Explanation- The plasma proteins are a mixture that contains albumin, globulins, and fibrinogen, with an average molecular weight of 69,000, 140,000, and 400,000, respectively. Thus, 1 gram of globulin contains only half as many molecules as 1 gram of albumin, and 1 gram of fibrinogen contains only one sixth as many molecules as 1 gramof albumin. It should be recalled from the discussion of osmotic pressure in Chapter 4 that osmotic pressure is determined by the *number of molecules* dissolved in a fluid rather than by the mass of these molecules. Thus, about 80 percent of the total colloid osmotic pressure of the plasma results from the albumin, 20 percent from the globulins, and almost none from fibrinogen.

80. a) Cr^{51}

(Ref- Guyton Physiology 13th edition-page 309).

81. d) Glucose into the adipocytes

Explanation- Glucose transport into adipocytes requires uptake via GLUT- 4 which is insulin dependent, therefore requires carrier and no energy and is passive transport.

82. d) Lipid solubility

(Ref- Guyton Physiology 13th edition-page 48).

Explanation- Diffusion of Lipid-Soluble Substances Through the Lipid Bilayer. An important factor that determines how rapidly a substance diffuses through the lipid bilayer is the lipid solubility of the substance. For instance, the lipid solubilities of oxygen, nitrogen, carbon dioxide, and alcohols are high, and all these substances can dissolve directly in the lipid bilayer and diffuse through the cell membrane in the same manner that diffusion of water solutes occurs in a watery solution. The rate of diffusion of each of these substances through the membrane is directly proportional to its lipid solubility.

Nerve and Muscle – Questions

Q1. Amongst the muscles, skeletal muscle is the most excitable tissue because –

a. There are two 'T' tubules per sarcomere and has well developed sarcoplasmic reticulum
b. It is supplied by large myelinated nerve fibres
c. It is nerve regulated
d. None of the above

Q2. Gap junctions are found in –

a. Intestine b. Brain
c. Kidney d. Cardiac muscles

Q3. In a neuron, graded electrogenesis occurs at –

a. Soma-dendritic zone
b. Initial segment
c. Axon
d. Nerve ending

Q4. Synaptic potentials can be recorded by–

a. Patch clamp technique
b. Voltage clamp technique
c. Microelectrode
d. EEG

Q5. Amplitude of action potential is predominantly determined by –

a. Equilibrium potential of Na^+
b. Equilibrium potential of K^+
c. Equilibrium potential of CL
d. Equilibrium potential of HCO_3

Q6. Hyponatremia has no effect on the RMP (resting membrane potential) because –

a. The cell membrane is impermeable to Na^+
b. ECF Na^+ concentration is high
c. Intracellular K^+ concentration is high
d. Equilibrium potential for Na^+ is +60 mV.

Q7. NERNST potential of Na^+ in mV is-

a. +61 b. -60
c. +90 d. -80

Q8. Cell junction in single unit type of smooth muscle is –

a. Zonula adherens
b. Macula adherens
c. Tight junction
d. Gap junction

Q9. Protein attached to 'Z' line in cardiac muscle, which is responsible for elasticity is–

a. Troponin b. Tropomyosin
c. Titin d. Actin

Q10. Equilibrium potential for an ion is calculated using –

a. Gibbs Donnan equation
b. Goldman equation
c. Nernst equation
d. Henderson Hesselbach equation

Q11. When extracellular potassium is increased from 4 meq to 10 meq (hyperkalemia) what will happen –

a. Resting membrane potential becomes more negative.
b. Resting membrane potential becomes less negative
c. Increase in conductance of sodium
d. Increase in conduction of potassium

Q12. Action potential is initiated at the Axon Hillock – Initial segment of the neuron because

a. Threshold for excitation is lowest.
b. Neurotransmitter is released at this site
c. It is an unmyelinated segment
d. Has lowest concentration of voltage gated sodium channels

Q13. Sarcomere is the area between –

a. Two consecutive I bands
b. Two adjacent Z lines
c. A band and I band
d. Two H zones

1. a	2. d	3. a	4. c	5. a	6. a	7. a	8. d	9. c	10. c
11. b	12. a	13. b							

Q14. Ca^{2+} Channel blockers would have a significant effect on muscle function in –

a. Skeletal muscle
b. Smooth muscle
c. Both the above
d. Neither

Q15. Which of the following is not true for cardiac and skeletal muscle fibers?

a. Both cardiac and skeletal muscles exhibit graded contraction
b. Excitation- contraction coupling in both depends upon increased intracellular Calcium
c. Excitation-contraction coupling is not dependent on extracellular Ca2+ in skeletal muscle
d. Cardiac action potential has a plateau and a longer refractory period

Q16. Skeletal muscle contraction all are true except-

a. Depends on action potential
b. Recruitment of more number of fibres produces more contraction
c. Increase in the strength of action potential increase contraction
d. Increase in initial length of muscle fiber increases tension generated

Q17. First change to occur in the distal segment of cut nerves-

a. Myelin degeneration
b. Axonal degeneration
c. Mitosis of schwann cell
d. Sprouting.

Q18. Conduction in which type of nerve fibres is blocked maximally by pressure-

a. C fibres b. A- alpha fibres
c. A- Beta d. A- gamma.

Q19. In excitable cells, repolarization is closely associated with one of the following events-

a. Na efflux b. Na influx
c. K efflux d. K influx

Q20. A unique characteristic of smooth muscle is that –

a. It can sustain a contraction for prolonged periods
b. Calcium is not required for contraction
c. Repetitive contractions are not possible
d. Myosin filaments are not required

Q21. The band which disappears on muscular contraction is-

a. H b. I
c. A d. Z

Q22. Relation between nerve thickness and conduction velocity is –

a. Linear b. Parabolic
c. Hyperbolic d. No relation

Q23. Unidirectional transport is seen across-

a. Axon
b. Synapse
c. Both of above
d. None of above

Q24. Normal resting membrane potential of a large motor neuron is –

a. -50 to -60 mV
b. -80 to -90 mV
c. -100 to -110 mV
d. -30 to -50 mV

Q25. Best method to increase, the muscle strength is –

a. Isometric exercise
b. Isotonic exercise
c. Aerobic Isotonic exercise
d. Electrical stimulation

Q26. Chronaxie indicates-

a. Magnitude of the current
b. Rate of discharge
c. Velocity of nerve conduction
d. Excitability

Q27. There is mutation of gene coding for the ryanodine receptors in malignant hyperthermia. Which of the following statements best explains the increased heart production in malignant hyperthemia-

a. Increased muscle metabolism by excess of calcium ions
b. Thermic effect of food
c. Increased sympathetic discharge
d. Mitochondrial thermogenesis.

14. b	15. a	16. c	17. b	18. b	19. c	20. a	21. a	22. a	23. b
24. b	25. a	26. d	27. a						

Q28. Fast twitch muscle fibres in comparison to slow twitch muscle fibres have more-

a. Mitochondria b. C-AMP
c. Cytoplasm d. Enzymes

Q29. Tissue with least chronaxie-

a. Smooth muscle
b. Cardiac muscle
c. Skeletal muscle
d. Nerve

Q30. Neuronal degeneration is seen in all of the following except-

a. Crush nerve injury
b. Fetal development
c. Senescence
d. Neuropraxia

Q31. Group A nerve fibers are most susceptible to –

a. Pressure
b. Hypoxia
c. Local anaethetics
d. Temperature

Q32. The 'C' type nerve fibers are highly susceptible to –

a. Hypoxia
b. Pressure
c. Local anesthetics
d. All of the above

Q33. Which of the following types of nerve fibers carry pain-

a. A α b. A β
c. A γ d. A δ

Q34. Fine, irregular contraction of individual fibers called-

a. Fasciculations
b. Fibrillation
c. Tics
d. Spasm

Q35. The site where myosin head attaches to actin in skeletal muscles are covered by-

a. Tropomyosin
b. Troponin
c. Calcium
d. None of the above

Q36. Which of the following is not a Sarcolemmal proteins?

a. Sarcoglyca
b. Dystrophin
c. Dystroglycan
d. Perlecan

Q37. Equilibrium potential for an ion is calculated using

a. Gibbs Donnan equation
b. Glodman equation
c. Nernst equation
d. Henderson Hasselbach equation

Q38. RMP is mainly due to which ion?

a. Sodium b. Potassium
c. Calcium d. Chloride

Q39. The force of muscle contraction can be increased by all of the following except-

a. Increasing the frequency of activation of motor units
b. Increasing the number of motor units activated
c. Increasing the amplitude of action potentials in the motor neurons
d. Recruting larger motor units

Q40. Duchenne muscular dystrophy is a disease of –

a. Neuromusculer junction
b. Sarcolemal proteins
c. Muscle contractile protein
d. Disuse atrophy due to muscle weakness

Q41. In skeletal muscle, actin is bound to Z line by-

a. Titin b. Desmin
c. Actinin d. Tropomyosin

Q42. True regarding RMP is all except-

a. -70 mV in neurons
b. Is due to K+ ions
c. $Na^+ - K^+$ pumps 3 Na^+ out of cell & $2K^+$ inside
d. $Na^+ - K^+$ pumps $3K^+$ out of cell & 2 Na^+ inside of cell

28. d	29. a	30. d	31. a	32. c	33. d	34. b	35. a	36. d	37. c
38. b	39. c	40. b	41. c	42. d				

Q43. Amplitude of action potential is predominantly determined by

a. Equilibrium potential of Na^+
b. Equilibrium potential of K^+
c. Equilibrium potential of Ca2+
d. Equilibrium potential of HCO_3

Q44. Hyponatremia has no effect on the RMP (resting membrane potential) because

a. The cell membrane is impermeable to Na^+ at rest
b. ECF Na^+ concentration is high
c. Intracellular K^+ concentration is high
d. Equilibrium potential for Na^+ is + 60mV.

Q45. NERST's potential of Na^+ is –

a. +61 b. -60
c. +90 d. -80

Q46. What is / are effect on membrane when extra cellular concentration of K^+ of decreased ?

a. ↓ magnitude of RMP
b. ↑Negativity of the membrane
c. ↑magnitude of RMP
d. ↓Negativity of membrane

Q47. Action potential is:

a. Decremental phenomenon
b. Doesn't obey all or none phenomenon
c. K^+ goes from ECF to ICF
d. Threshold stimulus is required

Q48. Type I muscle fibers are :

a. Red b. Anerobic
c. Large d. Glycolytic

Q49. Most susceptible tissue to hypoxia

a. Muscle b. Neurons
c. Hepatocytes d. Myocytes

Q50. Resting membrane potential is generated mainly by :

a. Na^+ b. K^+
c. CI d. CA^{2+}

Q51. Resting membrane potential of neuron is :

a. + 70 mv b. – 70 mv
c. + 90 mv d. -90 mv

Q52. When sodium enters cells :

a. There is spike in action potential
b. There is plateau in action potential
c. There is repolarization
d. There is hyperpolarization

Q53. Tetanic contraction is due to accumulation of :

a. Na^+ b. Ca^{2+}
c. K^+ d. Cl^-

Q54. Sarcomere is the area between :

a. Two consecutive 1 brands
b. Two adjacent z lines
c. A band I band
d. Two H zones

Q55. Which is true about Type - 2 muscle fibres :

a. Increased myoglobin
b. It is slower, oxidative and red
c. Increased isoenzyme ATPase activity
d. Glycolytic capacity- moderate

Q56. Synaptic conduction is mostly ortho-dromic because :

a. Dendrites
b. Once repolarized an area cannot be depolarized
c. The strength of antidromic impulse is less
d. Chemical mediator is located only in the presynaptic terminal

Q57. Chronaxie minimum in :

a. Mixed nerves
b. Unmyelinated
c. Myelinated nerve
d. Sensory nerves

Q58. Thin filament is mainly composed of :

a. Actin b. Myosin
c. Tropomyosin d. Dystrophin

Q59. Which of the following is a relaxation protein?

a. Actin b. Myosin
c. Tropomyosin d. Dystrophin

Q60. RMP of smooth muscle is :

a. - 50 to -60 mV
b. -75 mV
c. -90 mV
d. -35 mV

43. a	44. a	45. a	46. b,c	47. d	48. a	49. b	50. b	51. b	52. a
53. b	54.	55. c	56. d	57. c	58. a	59. c	60. a		

Q61. Protein specific for smooth muscle contraction is :

a. Troponin b. tropomyosin
c. Myosin d. Calmodulin

Q62. Troponin- C mimics which of the following:

a. Calmodulin b. Calcineurin
c. Calretinin d. Ceruloplasmin

Q63. True about type 2 muscle fibre :

a. White, glycolytic, fast contracting
b. White, oxidative, slow contracting
c. Red, oxidative, fast contracting
d. Red, glycolytic, slow contracting

Q64. Maximum concentration of sodium channels per unit area is at :

a. Cell body at dendrite end
b. Initial segment
c. Axon below myelin
d. Node of Ranvier

Q65. In action potential of nerve the overshoot is :

a. Above zero potential
b. Below zero potential
c. Below resting membrane potential
d. Above resting membrane potential

Q66. All of the following are true about excitation contraction coupling except:

a. Acetylcholine is released at the nerve terminal
b. Calcium is pumped back into the sarcoplasmic reticulum during relaxation
c. Calcium is released from sarcoplasmic reticulum during contraction
d. Calcium binds to tropomyosin to initiate muscle contraction

Q67. Protein connecting Z – lines :

a. Kinin b. Desnin
c. Titin d. Actin

Q68. Less mitochondria are seen in :

a. Red fibers b. Type I fibers
c. White fibers d. Slow fibers

Q69 Calcium ions in skeletal muscles are:

a. Transverse tubule
b. Longitudinal part
c. Terminal cistern
d. Sarcolemma

Q70. Resting skeletal muscles use the:

a. GLUT-1 TRANSPORTER
b. GLUT-2 TRANSORTER
c. GLUT-3 TRANSPORTER
d. GLUT-4 TRANSPORTER

Q71. Calmodulin acts by:

a. Opening of Na^+ channels
b. Phosphorylation of myosin by protein kinase
c. Activation of Na^+-K^+pump
d. Dephosphorylation by protein kinase

Q72. Post - ganglionic parasympathetic fibers are :

a. A α b. A β
c. A γ d. C

Q73. 'Patch clamp' is used for :

a. To record facilitated diffusion
b. To record flow in voltage gated channel
c. To record osmotic pressure around semipermeable membrane
d. To record RMP

Q74. Hyperpolarization is caused by which ions :

a. K^+ b. Na^+
c. Ca^{++} d. HCO_3^-

Q75. ATPase activity is present in :

a. Actin b. Myosin
c. Troponin d. None

Q76. All are true about red muscle fibers except :

a. More mitochondria
b. Glycolytic metabolism
c. More myoglobin
d. More oxidative capacity

Q77. Smooth muscle cell membrane is :

a. Sarcoplasm
b. Sarcolemma
c. Sarcomere
d. Sarcoplasmic reticulum

61. d	62. a	63. a	64. d	65. b	66. d	67. c	68. c	69. c	70. d
71. b	72. d	73. c	74. b	75. b	76. b	77. b			

Q78. White fibres are predominant in :
a. Calf muscles
b. Extraocular muscle
c. Back muscles
d. Hip muscles

Q79. Fast fatiguable motor unit is recruited:
a. First
b. Last
c. During active part of contraction
d. During relaxation

Q80. After application of one stimulus the time period in which the second stronger stimuli can form an impulse is called :
a. Latent refractory period
b. Absolute refractory period
c. Local response
d. Relative refractory period

Q81. Tight junctions are seen in all except
a. Cardiac muscle
b. Renal tubules
c. Intestine
d. choroid plexus

Q82. Equilibrium potential of K^{+}
a. -70mV b. -90mV
c. +70mV d. +90mV

Q83. How many muscle fibers are there in one motor unit in extraocular muscles :
a. 15 b. 30
c. 5 d. 50

Q84. Dorsal root ganglia have :
a. Unipolar b. Multiplolar
c. Bipolar d. Pseudounipolar

Q85. Fibres most sensitive to LA are -
a. A b. B
c. C d. None of the above

Q86. There are two electrodes placed at a distance of 4.5 cm and it takes 1.5 ms for current to be propagated along the nerve from one to another electrode. The velocity of nerve conduction is :
a. 60m/s b. 30m/s
c. 45m/s d. 80m/s

Q87. Calcium is pumped back into sarcoplasmic reticulum by :
a. SERCA
b. Sodium pump
c. Rinotidine receptor
d. None

Q88. Pain fibers are of which type :
a. Type A α b. Type A β
c. Type B d. Type C

Q89. Resting membrane potential in ventricular myocardium :
a. -50mV b. -70mV
c. +70mV d. -90mV

Q90. Percentage of sensory fibers in a pure motor nerve is :
a. 0% b. 10%
c. 2% d. 40%
e. 25%

Q91. Following tetanising stimulus given to a muscle there is an increased contraction. This is due to –
a. Recruitment phenomenon
b. B
c. Contraction of different muscle fibers at different places
d. All of the above

Q92. The extracellular potassium concentration is 100meq/mmol and intracellular potassium concentration is 10 meq/mmol. What will be the equilibrium potential for potassium according to Nernst equation? (AIIMS 2016)
a. 0 V b. -60 V
c. 90 V d. + 30 V

Q93. Considering the latent period of muscle twitch to be 10ms , contraction time is 40ms and relaxation time 50ms , what will be the tetanizing frequency for this muscle. (AIIMS 2016)
a. 25Hz b. 50 HZ
c. 100 Hz d. 75 HZ

78. b	79. b	80. d	81. a	82. b	83. c	84. d	85. a	86. b	87. a
88. d	89. d	90. d	91. b	92. b	93. a				

Q94. Which of the following is the constituent of the marked area in the electron microscopic picture of muscle? (AIIMS 2016)

a. Alpha actinin b. Nebulin
c. Titin d. Tropomodulin

Q95. In the following electron micrograph of sarcomere correctly identify the area labelled as "E". (AIIMS 2016).

a. A -band b. I- Band
c. M- Band d. H-zone

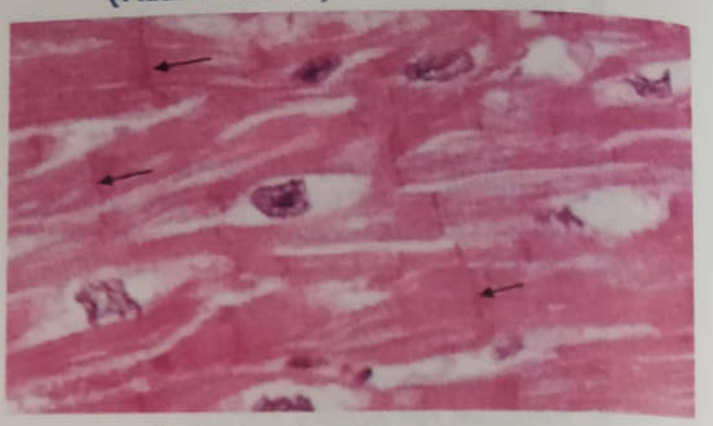
Q96. Rapid source of energy by resynthesizing ATP for exercising muscles is: (AIIMS 2016)

a. Glycolysis b. Glycogenolysis
c. TCA cycle d. Phosphocretine

Q97. Potential developed due to movement of freely diffusible ions across a semi-permeable membrane is calculated using: (AIIMS 2016)

a. Nernst equation
b. Gibbs equation
c. Goldman-Hodgkin-Katz equation
d. Fick principle

Q98. Which of the following functional proteins are not seen in the region marked in the image shown? (AIIMS 2017)



a. Macula adherens
b. Fascia adherens
c. Connexons
d. Zona occludens

Q99. Which one of the following is responsible for absolute refractoriness of a nerve fibre during an impulse? (AIIMS 2017)

a. Closure of the inactivation gates of Na^+ channels
b. Closure of activation gates of Na^+ channels
c. Efflux of K^+ from cell
d. Cl^- Channel closure

Q100. X, Y and Z substances can cross a cell membrane free. At resting state, if X and Y carry currents of -30pa and -50 pa respectively, what current does Z carry: (AIIMS 2017)

a. +40 b. +80
c. -10 d. -20

94. a	95. b	96. d	97. a	98. d	99. a	100. b

Nerve and Muscle – Explanations

1. a) There are two 'T' tubules per sarcomere and has well developed sarcoplasmic reticulum

(Ref- Ganong's Review of Medical Physiology 25th edition- page 102).

Explanation- The T system, which is continuous with the sarcolemma, provides a path for the rapid transmission of the action potential from the cell membrane to all the fibrils in the muscle. The sarcoplasmic reticulum is an important store of Ca2+ and also participates in muscle metabolism.

2. d) Cardiac muscles

(Ref- Ganong's Review of Medical Physiology 25th edition- page 112)-

Explanation- Along the sides of the muscle fibers next to the disks, the cell membranes of adjacent fibers fuse for considerable distances, forming gap junctions. These junctions provide low-resistance bridges for the spread of excitation from one fiber to another. They permit cardiac muscle to function as if it were a syncytium,

3. a) Soma-dendritic zone

(Ref- Ganong's Review of Medical Physiology 25th edition- page 126).

Explanation- Graded electrogeneis is local potential generation which occurs in dendrite or soma.

4. c) Patch clamp technique

(Ref- Ganong's Review of Medical Physiology 25th edition- page 121).

Explanation- Synaptic potential is recorded with inserting one micro-electrode inside cell and one electrode outside cell.

5. a) Equilibrium potential of Na^+

(Ref- Ganong's Review of Medical Physiology 25th edition- page 91).

Explanation- Maximum magnitude is determined by equilibrium potential of Na^+.

6. a) The cell membrane is impermeable to Na^+

(Ref: Kandel's Principles of Neural science, 5th edition, page 135).

Explanation- Permeability of different ions through cell membrane is K+>> Cl->>Na+.

7. a) +61

(Ref: Guyton's Physiology 13th edition, page 63).

Explanation- The ratio of sodium ions from inside to outside the membrane is 0.1, which gives a calculated Nernst potential for the inside of the membrane of +61 millivolts.

8. d) Gap junction

(Ref- Ganong's Review of Medical Physiology 25th edition- page 115)

Explanation- Unitary smooth muscle occurs in large sheets, has many low-resistance gap junctional connections between individual muscle cells, and functions in a syncytial fashion. Unitary smooth muscle is found primarily in the walls of hollow viscera

9. c) Titin

(Ref- Ganong's Review of Medical Physiology 25th edition- page 101)-

Explanation- Titin, the largest known protein (with a molecular mass near 3,000,000 Da), connects the Z lines to the M lines and provides scaffolding for the sarcomere.

10. c) Nernst equation

(Ref- Ganong's Review of Medical Physiology 25th edition- page 90).

11. b) Resting membrane potential becomes less negative

(Ref: Principles of Neural science, 4th edition by Eric Kandel).

Explanation- Hyperkalemia cause less shift of K+ from cell interior. Due to gain of extra K+(positive ions)RMP of the cell becomes less negative (which is known as decrease in RMP).

12. a) Threshold for excitation is lowest

(Ref: Kandel's Principles of Neural science, 5th edition, page 32).

Explanation- Because the initial segment of the axon has highest density of voltage sensitive Na+ channels and therefore the lowest threshold for generating the action potential.

13. b) Two adjacent Z lines

(Ref- Ganong's Review of Medical Physiology 25th edition- page 101).

14. b) Smooth muscle

Explanation- Since sarcoplasmic reticulum is rudimentary- less developed in smooth muscle and the main mechanism for excitation contraction coupling is Calcium Induced Calcium Release (CICR) so, main action of Ca2+ channel blockers is in smooth muscle.

15. a) Both cardiac and skeletal muscles exhibit graded contraction

(Ref: Guyton's Physiology 13th edition, page 96).

Explanation- Cardiac muscle cannot be tetanized due to long refractory period.

16. c) Increase in the strength of action potential increase contraction

(Ref- Ganong's Review of Medical Physiology 25th edition- page 103).

Explanation- Action potential follows all or none law – so, amplitude of action potential normally does not change.

17. b) Axonal degeneration

(Ref: Kandel's Principles of Neural science, 5th edition, page 1286).

Explanation- After axotomy the nerve terminals of the injured neuron begin to degenerate (first). The distal axonal stump separates from the parental cell body, becomes irregular, and undergoes Wallerian degeneration.

18. b) A- alpha fibres

(Ref- Essentials of Orthopaedics & Applied Physiotherapy By Jayant Joshi).

Explanation- Largest myelinated fiber is most susceptible to pressure induced conduction block. So, A alpha I will be blocked maximally by pressure followed by A beta and A delta.

19. c) K efflux

(Ref- Ganong's Review of Medical Physiology 25th edition- page 90).

Explanation- In addition, the direction of the electrical gradient for Na+ is reversed during the **overshoot** because the membrane potential is reversed, and this limits Na+ influx; also the voltage-gated K+ channels open. These factors contribute to **repolarization.** The opening of voltage-gated K+ channels is slower and more prolonged than the opening of the Na+ channels,

20. a) It can sustain a contraction for prolonged periods

(Ref- Guyton Physiology 12th edition- page 97).

Explanation- a latch bridge is a sustained contraction with less no. of crossbridge cycle and less ATP use. In this situation, even after dephosphorylation, myosin heads remain attached with actin.

21. a) H

(Ref- Ganong's Physiology 25th edition- page 101)

Explanation- during muscle contraction- length of I and H band decreases , A band remains constant and M line becomes prominent.

22. a) Linear

(Ref. Form and Function in Brain and Spinal cord: Perspectives of a Neurologist by Waxman & McDonald, page 6).

Explanation- The relationship is linear for myelinated axons and parabolic for unmyelinated axons.

23. b) Synapse

(Ref- Ganong's Physiology 24th edition- page 88).

Explanation- In the natural situations impulse pass in one direction only ie. from synaptic junctions or receptors along axons to their termination. Such conduction is called orthodromic. Conduction in opposite direction is called antidromic.

24. b) -80 to -90 mV

(Ref- Ganong's Physiology 25th edition- page 102).

Explanation- The resting membrane potential of skeletal muscle is about –90 mV.

25. a) Isometric exercise

(Ref. Comprehensive Textbook of Medical Physiology, GK Pal, 1st edition, pp 1012).

Explanation- Weight lifting can enhance muscle strength but cannot provide resistance to fatigue.

26. d) Excitability

(Ref. Comprehensive Textbook of Medical Physiology 1st edition, pp 191).

Lesser is the chronaxie greater is the excitability.

27. a) Increased muscle metabolism by excess of calcium ions

(Ref- Ganong's Physiology 24th edition- page 98- Clinical Box).

Explanation- Malignant hyperthermia has been traced to the mutation in RyR, the Ca2+ release channel in the sarcoplasmic reticulum. The mutation results in an inefficient feedback mechanism to shut down Ca2+ release after the stimulation of the RyR. and thus increased contractility and the heat generation.

28. d) Enzymes

(Ref- Ganong's Physiology 25th edition- page 108).

29. a) Smooth muscle

(Ref. Comprehensive Textbook of Medical Physiology 1st edition, pp 191).

Explanation- Nerve has lesser chronaxie than skeletal muscles.

30. d) Neuropraxia

(Ref: Physical Medicine and Rehabilitation Board Review, 3rd edn, By Sara J. Cuccurullo, pp 355).

Explanation- In neuropraxia axon is intact, only local myelin injury occurs, which leads to conduction block.

31. a) Pressure

(Ref- Ganong's Physiology 24th edition- page 90 table).

32. c) Local anesthetics

(Ref- Ganong's Physiology 24th edition- page 90 table).

33. d) A δ

(Ref- Ganong's Physiology 24th edition- page 169).

Explanation- Superficial pain – A delta.

34. b) Fibrillation

(Ref- Ganong's Physiology 24th edition- page 104).

Explanation- Fine irregular contractions of individual fibres are known as fibrillations. This is the classic picture of lower motor neuron lesion. If the motor nerve regenerates, the fibrillations disappear.

35. a) Tropomyosin

(Ref- Guyton's Physiology 13th edition- page 89).

Explanation- In the resting state tropomyosin molecules lie on top of the active sites of the actin strands, so that attraction cannot occur between actin and myosin filaments to cause contraction.

36. d) Perlecan

(Ref- Ganong's Physiology 24th edition- page-97).

Explanation- Perlecan is a large extracellular matrix glycoprotein that plays a crucial role in tissue development and organogenesis.

37. c) Nernst equation

(Ref- Ganong's Physiology 24th edition- page 84).

38. b) Potassium

(Ref- Ganong's Physiology 24th edition- page 84).

39. c) Increasing the amplitude of action potentials in the motor neurons

(Ref- Ganong's Physiology 24th edition- page 101).

Explanation- Increasing the frequency of motor unit activation leads to summation of contractions, which increases force of contraction. More motor unit activation or larger motor unit activation means

larger number of fibers will contract simultaneously, so force of contraction will be more.

40. b) Sarcolemal proteins

Ref- Guyton's Physiology 13th edition- page 87).

Explanation- Duchenne muscular dystrophy (DMD). This disease affects only males because it is transmitted as an X-linked recessive trait and is caused by a mutation of the gene that encodes for a protein called *dystrophin*, which links actins to proteins in the muscle cell membrane. Dystrophin and associated proteins form an interface between the intracellular contractile apparatus and the extracellular connective matrix.

41. c) Actinin

(Ref. Comprehensive Textbook of Medical Physiology 1st edition, pp 101).

Explanation- Alpha actinin anchors the thin filaments to Z line.

42. d) Na^+ - K^+ pumps 3K^+ out of cell & 2 Na^+ inside of cell

(Ref. Ganong's Reviewof Medical Physiology 24th edition, pp 47).

43. a) Equilibrium potential of Na^+

(Ref. Ganong's Reviewof Medical Physiology 25th edition, pp 90).

44. a) The cell membrane is impermeable to Na^+ at rest

(Ref. Principles of Neural Science- 4th edition by Eric Kendel).

45. a) +61

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 90).

46. b) ↑Negativity of the membrane
c) ↑magnitude of RMP

(Ref. Principles of Neural Science- 4th edition by Eric Kendel).

Explanation- Hypokalemia causes shift of extra K+ from the cell interior. Due to loss of extra K+ (positive charge) , RMP of the ions become more negative (increase in RMP).

47. d) Threshold stimulus is required

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 91,92,93).

48. a) Red

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 108).

Explanation- Type 1 muscle fibers are oxidative, slow twitch oxidative with high capillary density and myoglobin content. So, the color is red.

49. b) Neurons

(Ref. Neuropathology by Richard A Prayson).

Explanation- Irreversible damage occurs if there is no oxygen for > 5 mins.

50. b) K^+

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 84).

51. b) – 70 mv

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 90).

52. a) There is spike in action potential

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 90).

53. b) Ca^{2+}

(Ref. Medical Physiology for Undergraduate Students- Indu Khurrana- pp 77).

Explanation- The Ca2+ ions released in the cytoplasm during single muscle twitch are removed quickly and relaxation occurs. When the muscle is stimulated in rapid succession, there occurs a progressive accumulation of Ca2+ ions in cytoplasm. The longer stay and increased amount of Ca2+ ions in the cytoplasm increase the tension developed rises to tetanic levels.

54.

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 101).

Explanation- Sarcomere is the distance between two z lines. In resting condition, this length is 2.0 to 2.2 µm.

55. c) Increased isoenzyme ATPase activity

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 108)

56. d) Chemical mediator is located only in the presynaptic terminal

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 88).

57. c) Myelinated nerve

Myelinated nerves have greatest excitability so chronaxie is least.

58. a) Actin

(Ref. Ganong's Review of Medical Physiology 25th edition, pp101)

Explanation- The thin filaments are polymers made up of two chains of actin that form a long double helix

59. c) Tropomyosin

(Ref- Guyton's Physiology 13th edition- page 89).

60. a) - 50 to -60 mV

(Ref. Ganong's Review of Medical Physiology 25th edition, pp115)

Explanation-In periods of relative quiescence values for resting potential are on the order of –20 to –65 mV. Smooth muscle cells can display divergent electrical activity

61. d) Calmodulin

(Ref. Ganong's Review of Medical Physiology 24th edition, pp110)

Explanation- In smooth muscle Ca2+ binds to calmodulin (troponin is absent).

62. a) Calmodulin

(Ref. Ganong's Review of Medical Physiology 24th edition, pp110)

Explanation- In smooth muscle Ca2+ binds to calmodulin (troponin is absent).

63. a) White, glycolytic, fast contracting

(Ref. Ganong's Review of Medical Physiology 25th edition, pp108)

Explanation- Type II fibers are white muscle fibers with fast twitch and high glycolytic activity.

64. d) Node of Ranvier

(Ref. Kandel's Principles of Neural Science 5th edition, pp32).

65. b) Below zero potential

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 91).

66. d) Calcium binds to tropomyosin to initiate muscle contraction

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 96)

Explanation- Troponin-C contains the binding sites for 4 Ca2+ ions that help to initiate contraction.

67. c) Titin

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 101).

Explanation- Titin, the largest known protein (with a molecular mass near 3,000,000 Da), connects the Z lines to the M lines and provides scaffolding for the sarcomere. It contains two kinds of folded domains that provide muscle with its elasticity.

68. c) White fibers

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 108).

69. c) Terminal cistern

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 102)

Explanation- The sarcoplasmic reticulum is an important store of Ca2+ and also participates in muscle metabolism

70. d) GLUT-4 TRANSPORTER

(Ref. Guyton's Textbook of Medical Physiology 13th edition, pp 971)

Explanation- Although the precise cause of this decrease is unclear, one important effect of cortisol is to decrease translocation of the glucose transporters GLUT 4 to the cell membrane, especially in skeletal muscle cells, leading to insulin resistance.

71. b) Phosphorylation of myosin by protein kinase

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 110).

Explanation- In smooth muscle Ca2+ binds to Calmodulin , and the resulting complex activates calmodulin dependent myosin light chain kinase.

72. d) C

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 89 table).

73. c) To record osmotic pressure around semipermeable membrane

(Ref. Guyton's Textbook of Medical Physiology 13th edition, pp 50).

Explanation- Patch-Clamp Method for Recording Ion Current Flow Through Single Channels.

74. b) Na^+

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 91)

Explanation- The slow return of the K+ channels to the closed state also explains the after-hyperpolarization, followed by a return to the resting membrane potential . Thus, voltage-gated K+ channels bring the action potential to an end and cause closure of their gates through a negative feedback process.

75. b) Myosin

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 101)

Explanation- The form of myosin found in muscle is myosin-II, with two globular heads and a long tail. The heads of the myosin molecules form cross-bridges with actin. Myosin contains heavy chains and light chains, and its heads are made up of the light chains and the amino terminal portions of the heavy chains. These heads contain an actin-binding site and a catalytic site that hydrolyzes adenosine triphosphate (ATP).

76. b) Glycolytic metabolism

(Ref. Ganong's Review of Medical Physiology 25th edition, p108)

77. b) Sarcolemma

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 99)

78. b) Extraocular muscle

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 108).

79. b) Last

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 110).

Explanati on- The recruitment of motor units during muscle contraction is not random; rather it follows a general scheme, the size principle. In general, a specific muscle action is developed first by the recruitment of S muscle units that contract relatively slowly to produce controlled contraction. Next, FR muscle units are recruited, resulting in more powerful response over a shorter period of time. Lastly, FF muscle units are recruited for the most demanding tasks.

80. d) Relative refractory period

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 93).

Explanation- This refractory period is divided into an absolute refractory period, corresponding to the period from the time the firing level is reached until repolarization is about one-third complete, and a relative refractory period, lasting from this point to the start of after-depolarization. During the absolute refractory period, no stimulus, no matter how strong, will excite the nerve. However, during the relative refractory period, stronger than normal stimuli can cause excitation.

81. a) Cardiac muscle

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 112).

Explanation- Gap junctions are present in electrically excitable cells, such as neurons, heart and smooth muscle.

82. b) -90mV

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 84).

83. c) 5

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 110).

Explanation- In muscles such as those of the hand and those concerned with motion of the eye (ie, muscles concerned with fine, graded, precise movement), each motor unit innervates very few (on the order of three to six) muscle fibers. On the other hand, values of 600 muscle fibers per motor unit can occur in human leg muscles.

84. d) Pseudounipolar

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 81, fig. 4.3).

Explanation- Some sensory neurons are in a subclass of bipolar cells called pseudounipolar cells. As this cell develops, a single process splits into two, both of which function as axons- one going to skin or muscle and other going to spinal cord.

85. a) A

(Ref. Miller's Anesthesia by Roland D et al. 8th edn.)

Explanation- A drug bolus is delivered by percutaneous injection, analogous to clinical peripheral nerve block, how unequivocally that small myelinated axons (A gamma motor and A delta sensory fibers) are the most susceptible to impulse annihilation. Next in order of block are the large myelinated (A alpha and A beta) fibers , and the least susceptible are small nonmyelinated C fibers.

86. b) 30m/s

Velocity = Distance / Time = 4.5 cm/1.5 ms= 30m/s.

87. a) SERCA

(Ref. Ganong's Review of Medical Physiology 25th edition, pp 105).

Explanation- The released Ca2+ is quickly amplified through calcium-induced calcium release. Ca2+ concentration is reduced in the muscle cell by the sarcoplasmic or endoplasmic reticulum Ca2+ ATPase (SERCA). The SERCA pump uses energy from ATP hydrolysis to remove Ca2+ from the cytosol back into the terminal cisterns, where it is stored until released by the next action potential.

88. d) Type C

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 169).

89. d) -90mV

(Ref. Ganong's Review of Medical Physiology 24th edition, pp 113).

Explanation- The resting membrane potential of individual mammalian cardiac muscle cells is about –90 mV.

90. d) 40%

(Ref. General Anatomy by Vishram Singh, pp 130).

Explanation- The nerve supplying the muscle is motor nerve but strictly speaking, it is a mixed nerve. It contains motor fibers (60%) as well as sensory fiber (40%).

91. b) Increased Ca^{++} influx into muscle fibers

(Ref- Medical Physiology for Undergraduate students- Indu Khurrana- page77)-

Explanation- Ca2+ ions released in cytoplasm during a single muscle twitch are removed quickly and relaxation occurs. When the muscle is stimulated in rapid succession, there occurs a progressive accumulation of Ca2+ ions in cytoplasm.

92. b) -60 V

Ref:Ganong's Review of Medical Physiology 24/e p 10

Explanation- Equilibrium potential as per Nernst's Equation= 2.3RT/FZ logC1/C2

C1= Higher concentration

C2= Lower concentration

R= Gas constant

T= Absolute temp

Z= Valency

Now 2.3RT/F = 60mV

Hence, E(mv)= 60*log100/10

E= 60mV

Now, Intracellular potassium is less compared to extracellular potassium. Hence potassium will move from ECF to ICF. Hence ICF will be negative compared to ECF.

Hence E (mV) for potassium= -60mV

93. a) 25 HZ

(Ref:Ganong's Review of Medical Physiology 24/e p104).

Explanation- Twitch duration (contraction period) = 40ms= 0.4 sec

Tetanizing frequency= 1/Twitch duration = 1/0.4 = 25Hz

94. a) Alpha actinin

(Ref. Ganong, 25thed/p. 101).

Structural Proteins in Skeletal Muscle

TITIN

1. It is the largest known protein present in mammals
2. Also called as "muscle spring" because it is responsible for "Elasticity" in muscle connects the
3. Z lines to the M lines and provides scaffolding for the sarcomere

DESMIN

4. It is the intermediate filament of muscle
5. It connects Z lines to the plasma membrane

ACTININ

6. It binds actin to the Z lines

Dystrophin-Glycoprotein Complex

7. Adds strength to the muscle by providing a scaffolding for the fibrils and connecting them to the exterior
8. Its components are dystroglycan, merosin, syntrophins and sarcoglycan

95. b) I-Band

(Ref: Ganong 24/e Pg 99)

Explanation: The area marked as E is the lighter and isotropic band called as I band. It contains dark, Z line at its centre (A: A band, B: Actin filament, C: Sarcomere width, D: H zone)

96. d) Phosphocreatine

(Ref: Guyton 13/e pg 1087, Ganong 24/e pg 106)

Explanation: ATP stored in muscle and ATP from creatine phosphate called as phosphagen system is a rapid source of energy during exercise which sustains energy needs for 8 to 10 sec.

97. a) Nernst equation

(Ref: Ganong's Review of Medical Physiology 24/e pg9-10)

Explanation: if a cell membrane is freely permeable to an ion the magnitude of potential difference of the ion at equilibrium is given by Nernst equation.

98. d) Zona occludens

Explanation-The above image is of cardiac muscle, which shows all intercellular junctions except tight junctions (zona occludens).

99. a) Closure of the inactivation gates of Na^+ channels

(Ref: Chapter 5, Guyton & Hall textbook of medical physiology 13th edition, Pg-66)

Explanation-

• Absolute refractory period:

Corresponding to the period from the time the firing level is reached until repolarization is about one-third complete.

No stimulus, no matter how strong, will not excite the nerve during absolute refractory period

Cause - inactivation gates of the Na+ channel are closed when the membrane potential is depolarized. They remain closed until repolarization occurs. No action potential can occur until the inactivation gates open

• Relative refractory period:

Begins from the remaining part of repolarization to the end of action potential

Stronger than normal stimulus(suprathreshold stimulus) produces action potential in relative refractory period

Cause - The K+ conductance is higher than at rest, and the membrane potential is closer to the K+ equilibrium potential and, therefore, farther from threshold; more inward current is required to bring the membrane to threshold.

100. b) +80

(Ref: Ganong Review of Medical Physiology 25th edition, CH 4, pp-90).

Explanation-

No net electrogenic transfer at RMP means X + Y + Z = 0

Since X = -50 and Y = -30, then Z must be +80 since (-80 +80 = 0)

Kidney – Questions

Q1. Erythropoietin is secreted mainly by-

a. Liver
b. Adrenal cortex
c. Kidney
d. Bone marrow

Q2. Gold blatt hypertension is seen in ..... Hypertension-

a. Renovascular
b. Drug induced
c. Adrenal medullary tumour
d. Idiopathic

Q3. Atrial natriuretic peptide acts by-

a. Increasing renin secretion
b. Increasing venous pressure
c. Decreasing cardiac output
d. Increasing blood volume

Q4. The renal blood flow (in ml/ min is)-

a. 250
b. 800
c. 1260
d. 1500

Q5. In humans effective renal blood flow is-

a. 525
b. 425
c. 625
d. 725

Q6. GFR is increased when-

a. Plasma oncotic pressure is increased.
b. Glomerular hydrostatic pressure is decreased.
c. Tubular hydrostatic pressure is increased.
d. Increased renal blood flow.

Q7. Relaxation of mesangial cells of kidney is brought about by-

a. cAMP
b. PGF2
c. Vasopressin
d. Endothelin

Q8. Which of the following is not a part of filtration barrier in nephrons?

a. Endothelial cells
b. Basement membrane
c. Podocytes
d. Mesangium

Q9. GFR is measured by-

a. Creatinine clearance
b. Inulin clearance
c. PAH clearance
d. Creatine clearance

Q10. All of the following structures lie in renal medulla except-

a. Loop of Henle
b. Collecting duct
c. Juxta glomerular apparatus
d. Vasa recta

Q11. A substance is present in concentration of 2 mg% in afferent arteriole and 0 mg % in efferent arteriole. True about the substance is –

a. It is free filtered in the glomerulus
b. Absorbed in PCT
c. Secreted in cortical nephron
d. Impermeable in loop of henle

Q12. If technician gives 8 times the recommended dose of PAH- what will be RPF?

a. Normal
b. Falsely high
c. Falsely low
d. None of the above

Q13. Active reabsorption of amino acids exclusively occurs in-

a. PCT
b. TAL
c. CD
d. DCT

Q14. Maximum Na+ absorption through which transporter-

a. Na+ - K+ ATP ase
b. Na+- H+ exchanger
c. Na+K+ 2 Cl- co transporter
d. Na+- Cl- co transporter

Q15. Main function of DCT is-

a. Water absorption
b. Amino acids absorption
c. Acidification of urine
d. HCO3- reabsorption

1. c	2. a	3. d	4. c	5. c	6. d	7. a	8. d	9. b	10. c
11. a,c>a	12. c	13. a	14. b	15. c					

Q16. Active reabsorption of Na+ occurs in all segments of kidney except-

a. PCT
b. DCT
c. CD
d. Thin ascending loop of henle

Q17. Mechanism of water reabsorption in PCT is -

a. Passive transport
b. Active transport
c. Osmosis
d. Facilitated diffusion

Q18. PCT has which type of aquaporins?

a. Aquaporin- 2 b. Aquaporin- 4
c. Aquaporin- 3 d. Aquaporin- 1

Q19. Which of the following statements regarding water reabsorption in tubules is true?

a. The bulk of water reabsorption occurs secondary to Na reabsorption.
b. Majority of facultative water reabsorption occurs in collecting duct.
c. Obligatory reabsorption is ADH dependent.
d. 20% water is always reabsorbed irrespective of water balance.

Q20. Bicarbonate is maximally absorbed from-

a. PCT b. DCT
c. TAL d. Collecting duct

Q21. The high sodium content of the filtrate in renal medulla is because –

a. At the LOH there is counter current mechanism.
b. Increased blood flow to vasa recta
c. Increased excretion of Na from PCT
d. Increased absorption of Na from PCT

Q22. Renal medullary hyperosmolarity is due to-

a. Increased glucose
b. Increased sodium
c. Increased K
d. Urea
e. Creatinine

Q23. Tubuloglomerular feedback is mediated by-

a. Sensing of Na conc. in macula densa
b. Sensing of Cl conc. In macula densa.
c. Sensing of NaCl conc. in macula densa
d. Opening of voltage gated Na channels in afferent arteriole

Q24. Hypertonic urine is excreted due to absorption of water in -

a. Collecting ducts
b. DCT
c. Ascending part of LOH
d. Descending part of LOH

Q25. Glucose is transported in renal tubular cells by-

a. K+ symport
b. K+ antiport
c. Na+ cotransport
d. Na antiport

Q26. Several hormones regulate the tubular reabsorption of water and electrolytes at different sites in the nephron. Which of the following combinations is correct?

a. Angiotensin distal tubule
b. Aldosterone in collecting ducts
c. ADH in proximal tubule
d. ANP in LOH

Q27. Plasma glucose is 400mg/dL, GFR is 125mL/min, Tm if glucose is 375mg/min, what is the excretion rate of glucose?

a. 25 b. 425
c. 325 d. 125

Q28. The urge for micturition is felt when the bladder is filled with-

a. 100-200cc of urine
b. 200-300cc of urine
c. 300-400cc of urine
d. 700-800 cc of urine

Q29. Renin secretion is increased by all except-

a. Decreased Na in PCT
b. Afferent arteriolar low pressure
c. Decreased Na in DCT
d. Sympathetic nerve stimulation

16. a	17. c	18. d	19. a	20. a	21. a	22. b,d	23. c	24. a	25. c
26. b	27. d	28. a	29. None						

Q30. Most important buffer present in DCT is –

a. Bicarbonate b. Phosphate
c. Ammonia d. Protein

Q31. Bicarbonate is absorbed-

a. Actively in PCT
b. Actively in DCT
c. Indirectly in PC
d. Actively in DCT

Q32. Which of the following substances has the highest Tmax?

a. Plasma protein
b. Hb
c. Glucose
d. Sodium

Q33. Which of the following statement is true?

a. Fluid coming out of LOH is hypotonic
b. Descending limb of LOH is permeable to solutes
c. If clearance of substance is greater than GFR, then tubular secretion must be present
d. Clearance of a substance is always more than GFR if tubular secretion is present

Q34. A/E following are correct about renal physiology –

a. Distal tubule always receives hypo-osmotic solution
b. The kidneys receive 5 % of cardiac output
c. GFR is controlled by resistance in afferent and efferent arterioles
d. The glomerulus receives capillaries from afferent arteriole

Q35. Which of the following statements about renal function is not true?

a. Oncotic pressure of filtrate is equal to glomerular capillaries
b. If afferent arteriole is vasoconstricted, then pressure in glomerular capillaries will fall
c. The hydrostatic pressure of the peritubular capillaries determines the glomerulo tubular balance
d. Ureteric obstruction increases the hydrostatic pressure of Bowman's capsule and reduces the GFR

Q36. What is the clearance of a substance, if its concentration in plasma is 10mg%, concentration in urine is 100 mg% and urine flow is 2mL/min?

a. 0.2mL/min b. 2 mL/min
c. 200 mL/min d. 20mL/min

Q37. Not absorbed from the PCT-

a. Na^+ b. Phosphate
c. Bicarbonate d. H^+

Q38. Potassium is maximally absorbed in-

a. DCT b. LOH
c. PCT d. CD

Q39. Following cells are responsible for acid secretion in kidney-

a. P cells b. Mesangial cells
c. Pericytes d. I cells

Q40. The principal site of acidification of urine is-

a. DCT b. PCT
c. CD d. LOH

Q41. In the presence of vasopressin, the greatest fraction of filtered water is absorbed in the -

a. Proximal tubule
b. Loop of Henle
c. Distal tubule
d. Cortical collecting duct

Q42. Minimum urine osmolality that can be achieved by human kidney –

a. 100 mOsm/L b. 80 mOsm/L
c. 50 mOsm/L d. 20 mOsm/L

Q43. Maximum osmotic gradient is found in-

a. Outer medulla
b. Inner medulla
c. Outer cortex
d. Inner cortex

Q44. The high sodium content of filtrate in renal medulla is because –

a. At the LOH, there is counter current multiplier
b. Increased blood flow to vasa recta
c. Increased absorption of Na+ from PCT
d. Increased excretion of Na+ from PCT

30. c	31. c	32. c	33. c	34. b	35. a	36. d	37. d	38. c
39. d	40. c	41. a	42. c	43. b	44. a			

Q45. The prime driving force for counter current multiplier system is-

a. Medullary hyperosmolarity
b. Reabsorption of Na+ in TAL of LOH
c. Action of ADH via aquaporin channels
d. Urea recycling

Q46. Urinary concentrating ability of kidney is increased by-

a. Increase in RBF
b. Reduction of medullary hyperosmolarity
c. Increase in GFR
d. ECF volume contraction

Q47. Elimination of waste product from a normal person requires minimal amount of urine of –

a. 100 m
b. 200 mL
c. 500 mL
d. 1000 mL

Q48. A/E the following are component of counter current multiplier system –

a. TAL of LOH
b. TDL of LOH
c. Collecting duct
d. Vasa recta

Q49. A/E the following are component of counter current system –

a. Thin ascending limb of LO
b. TDL of LOH
c. Collecting duct
d. Vasa recta

Q50. Angiotensin- II causes all of the following except-

a. Stimulation of thirst
b. Aldosterone secretion
c. Increased ADH secretion
d. Vasodilatation

Q51. Which of the following is most important in Na+ and water retention?

a. Renin angiotensin system
b. ANP
c. BNP
d. Vasopressin

Q52. Which causes raised angiotensin in blood?

a. Increased cardiac output
b. Increased blood volume
c. Decreased blood pressure
d. Increased sympathetic tone

Q53. All reabsorbed substances have clearance-

a. Equal to inulin
b. Greater than inulin
c. Less than inulin
d. Insufficient information

Q54. In the formula of urea clearance, C=UXV/ P what does U stands for- (AIIMS 2016)

a. Urinary concentration/24hr
b. Urinary concentration in mg/ ml
c. Urine osmolarity
d. Urine volume per minute

Q55. All of these are actions of atrial natriuretic peptide except: (AIIMS 2016)

a. Afferent arteriolar dilatation
b. Mesangial cell constriction
c. Decreased sodium absorption in the PCT
d. Inhibition of sodium reabsorption in medullary collecting duct

Q56. Counter current mechanism is not seen in : (AIIMS 2016)

a. Kidney
b. Testes
c. Eye
d. Intestine

Q57. If there is efferent arteriole constriction, what will not happen? (AIIMS 2016)

a. Decrease in GFR
b. ↑ Glomerular hydrostatic pressure
c. Increase in oncotic pressure of peritubular capillaries
d. Decrease in blood flow of peritubular capillaries

Q58. What is incorrect about renal basement membrane? (AIIMS 2017)

a. It is a part of filtration barrier
b. It consists of type 3 collagen
c. It is stained with PAS
d. It has a lamina rara and lamina dura

45. b	46. d	47. c	48.d	49. a	50. d	51. a	52. c>d	53. c	54. b
55.b	56. c	57. a	58. b						

ANP — vasodilator
- Relax mesangial cell.
- ↓ Na+ reabsorpt
- ↑ Sc cap. permeability
- ↓ BP

Kidney – Explanations

1. c) Kidney

(Ref. Ganong's Physiology 24th edition. page. 667)

Explanation- In adults 85% of erythropoietin comes from the kidney and 15 % from the liver. Erythropoietin is produced by interstitial cells in peritubular capillary bed of the kidneys and by perivenous hepatocytes in liver.

2. a) Renovascular

(Ref. Ganong's Physiology 25th edition. page. 707).

Explanation- Constriction of one renal artery causes a prompt increase in renin secretion and the development of sustained hypertension **(renal** or **Goldblatt hypertension).** Removal of the ischemic kidney or the arterial constriction cures the hypertension if it has not persisted too long. In general, the hypertension produced by constricting one renal artery with the other kidney intact (one-clip, two-kidney Goldblatt hypertension) is associated with increased circulating renin. The clinical counterpart of this condition is **renal hypertension** due to atheromatous narrowing of one renal artery or other abnormalities of the renal circulation. However, plasma-renin activity is usually normal in one-clip one-kidney Goldblatt hypertension. The explanation of the hypertension in this situation is unsettled.

3. d) Increasing blood volume

(Ref. Ganong's Physiology 25th edition. page. 705).

Explanation- ANP and BNP in the circulation act on the kidneys to increase Na+ excretion and injected CNP has a similar effect. They appear to produce this effect by dilating afferent arterioles and relaxing mesangial cells. Both of these actions increase glomerular filtration (see Chapter 37). In addition, they act on the renal tubules to inhibit Na+ reabsorption (see Chapter 37). Other actions include an increase in capillary permeability, leading to extravasation of fluid and a decline in blood pressure.

4. c) 1260

(Ref. Ganong's Physiology 25th edition. page 674).

Explanation- In a resting adult, the kidneys receive 1.2–1.3 L of blood per minute, or just under 25% of the cardiac output.

5. c) 625

(Ref. Ganong's Physiology 25th edition. page. 677).

Explanation- PAH clearance is ERPF- 625mL/min.

Actual renal flow is = ERPF/ ER= 700 mL/ min. ARF

6. d) Increased renal blood flow.

(Ref. Ganong's Physiology 25th edition. page. 678).

Explanation- With increase in blood flow to the capillary – increases Hydrostatic pressure in capillaries .

7. a) cAMP

(Ref. Ganong's Physiology 25th edition. page. 678).

Explanation- PGE2 , ANP, Dopamine and cAMP- causes dilatation of mesangial cells.

8. d) Mesangium

(Ref. Ganong's Physiology 25th edition. page. 672).

9. b) Inulin clearance

(Ref. Ganong's Physiology 25th edition. page. 679).

Inulin clearance is = 125mL/min.

PAH clearance is ERPF- 625mL/min.

Creatinine clearance is not recommended due to errors in urine collection.

10. c) Juxta glomerular apparatus

(Ref. Ganong's Physiology 25th edition. page. 703).

Explanation- The macula, the lacis cells and renin secreting JG cells form JGA. This apparatus is always in present in cortex of the kidney.

11. a) It is free filtered in the glomerulus
c) Secreted in cortical nephron

(Ref. Ganong's Physiology 25th edition. page. 682).

Explanation- If the substance is freely filterable, them maximum amount of the substance that can be excreted is 0.16to 0.20 ie. filtration fraction(20% of plasma flow). So, the substance here has to be secreted.

12. c) Falsely low

(Ref. Ganong's Physiology 25th edition. page. 680).

PAH clearance is = 625 mL/min. On giving high concentrations of PAH, the PAH secretion maximum is saturated at PCT, after complete saturation-no more PAH will be secreted – so clearance falls.

13. a) PCT

(Ref. Ganong's Physiology 25th edition. page. 680).

Explanation- Near complete reabsorption of amino acids occurs in PCT – by Na+- AA co transporter system (secondary active transport).

14. b) Na+- H+ exchanger

(Ref. Clinic. Jour. Am. Soc. Nephrol; 2014: page 1).

Explanation- All Na+ reabsorption in PCT is driven directly or indirectly by Na+- K+ ATPase on B/L membrane. Quantitatively apical Na+- H+ exchanger reabsorbs maximum 60-70% so 100% Na+ reabsorption is linked to Na+- K+ ATP ase but NHE is the maximal luminal transporter.

15. c) Acidification of urine

(Ref. Ganong's Physiology 25th edition. page. 712).

Explanation- Acidification of urine occurs in distal tubule and collecting ducts, where H+ secretion is relatively independent of tubular H+ ion secretion. HCO_3^- – reabsorption and water reabsorption mainly occurs in PCT.

16. a) PCT

(Ref. Ganong's Physiology 25th edition. page. 680).

Explanation- Na+ is actively reabsorbed in all the segments of the kidney except thin portions of ascending loop of henle.

17. c) Osmosis

(Ref. Ganong's Physiology 25th edition. page. 687).

Explanation- Water moves rapidly out of the tubule along the osmotic gradient set up by the active transport of the solutes, and isotonicity is maintained.

18. d) Aquaporin- 1

(Ref. Ganong's Physiology 25th edition. page. 683).

Explanation- AQ-1 is localized to both apical and basolateral membrane of PCT.

19. a) The bulk of water reabsorption occurs secondary to Na reabsorption.

(Ref. Ganong's Physiology 25th edition. page. 682).

Explanation- Water reabsorption is maximum in PCT, which is set up by the osmotic gradients – active transport of Na+ and other solutes.

20. a) PCT

(Raff's Medical Physiology A Systems Approach, 2011, page 475).

Explanation- 80-90% of filtered bicarbonate is reabsorbed in PCT and another 10% is reabsorbed in TAL of LOH.

21. a) At the LOH there is counter current mechanism.

(Ref. Ganong's Physiology 25th edition. page. 686).

Explanation- Counter current mechanism is the main mechanism for urine concentration in renal medulla.

22. b) Increased sodium

d) Creatinine

(Ref. Guyton's Physiology 12th edition. page. 351, 13th edition, page 483).

Explanation- Renal medullary hyperosmolarity is due to active reabsorption of Na+ along with co- transport of Cl-, K+

and other ions out of the TAL into the medullary interstitium. Active transport of ions from CD into the medullary interstitium. Facilitated diffusion of large amounts of urea from the inner medullary collecting duct into the medullary interstitium. Little or no reabsorption of water from medullary tubules into the medullary interstitium.

23. c) Sensing of NaCl conc. in macula densa

(Ref. Ganong's Physiology 25th edition. page. 703).

Explanation- Macula densa senses both Na+ and Cl- but more sensitive to Cl-

24. a) Collecting ducts

(Raff's Medical Physiology A Systems Approach, 2011, page 654).

Explanation- Final conc. of urine is determined by water reabsorption at CD.

25. c) Na+ cotransport

(Ref. Ganong's Physiology 25th edition. page. 682).

26. b) Aldosterone in collecting ducts

(Ref. Ganong's Physiology 25th edition. page 704).

27. d) 125

(Ref. Ganong's Physiology 25th edition. page. 679).

Explanation- Net Glucose excreted =Filtered Glucose – Reabsorbed Glucose

Max reabsorbed glucose = Tmax = 375 mg/min.

Filtered glucose = Plasma conc of glucose x GFR- 400mg/ 100mL x 125= 500 mg/ min.

Reabsorbed glucose= 375mg/min.

So, excreted glucose – 500-375= 125 mg/min.

28. a) 100-200cc of urine

(Ref. Ganong's Physiology 25th edition. page. 692).

Explanation- These three components are sometimes called segments Ia, Ib, and II. The first urge to void is felt at a bladder volume of about 150 mL and a marked sense of fullness at about 400 mL. The flatness of segment Ib is a manifestation of the law of Laplace.

29. None >> Decreased Na+ in PCT

(Raff's Medical Physiology A Systems Approach, 2011, page 453).

Explanation-Stimuli for renin release– sympathetic stimulation, renal hypoperfusion or hypotension, decreased NaCl in macula densa and renal ischemia. So, NaCl in PCT is not a direct stimulator of renin release, but decrease NaCl in PCT also results in low delivery of NaCl in DCT (macula densa). This can stimulate renin.

30. c) Ammonia

(Ref. Ganong's Physiology 25th edition. page. 711).

Explanation- Phosphate and ammonia are both present in DCT, but secretion of ammonia increases in chronic acidosis to high level. So, ammonia has more capacity than phosphate.

31. c) Indirectly in PC

(Raff's Medical Physiology A Systems Approach, 2011, page 475).

Explanation- Bicarbonate reabsorption in PCT occurs indirectly via active secretion of H+ ion. In basolateral membrane, HCO3- is reabsorbed passively.

32. c) Glucose

(Ref. Guyton's Physiology 12th edition. page. 331, 13th edition, page 479).

Explanation- Tm for Glucose= 375mg/ min, for plasma proteins= 40mg/min and Na+ does not have Tm.

33. c) If clearance of substance is greater than GFR, then tubular secretion must be present

(Ref. Ganong's Physiology 25th edition. page. 679).

Explanation- If clearance of a substance is greater than GFR then secretion must be present but if secretion is present then clearance might not be more than GFR always as same substance after secretion can be reabsorbed in different segment of nephron- thus decreasing the clearance.

34. b) The kidneys receive 5 % of cardiac output

(Ref. Ganong's Physiology 25th edition. page. 602).

Explanation- Kidneys receive 20-23 % of total cardiac output.

35. a) Oncotic pressure of filtrate is equal to glomerular capillaries

(Ref. Ganong's Physiology 25th edition. page. 678).

Explanation- Oncotic pressure of glomerular capillaries is 32 mmHg but that of filtrate is 0 mmHg as there are no proteins in filtrate. Although oncotic pressure of peritubular capillary is the main determinant of glomerulo-tubular balance,hydrostatic pressure also helps in this process.

36. d) 20mL/min

(Ref. Ganong's Physiology 25th edition. page. 680).

Explanation- Clearance of a substance = U XV /P.

Where U= Urinary conc of the substance = 100 mg/dL

P= Plasma conc of the substance= 10 mg/dL

V= Urine flow rate- 2mL/min

So, clearance – 100 X 2/ 10 = 20mL/min.

37. d) H^+

(Raff's Medical Physiology A Systems Approach, 2011, page 475).

Explanation- H+ is secreted in PCT and not reabsorbed by Na^+ H^+ Exchanger

38. c) PCT

(Ref. Ganong's Physiology 25th edition. page. 689).

39. d) I cells

(Ref. Ganong's Physiology 25th edition. page. 710).

40. c) CD

CD> DCT (Ref. Ganong's Physiology 25th edition. page. 710).

Explanation- Acidification occurs in DCT and CD, but CD is more important.

41. a) Proximal tubule

(Ref. Ganong's Physiology 25th edition. page. 682)

Explanation- Water reabsorption in PCT is 60-70%, which occurs independent of ADH. Vasopressin increases permeability of collecting duct, in its absence water reabsorbed is 2 % but in its presence this can increase to 15%, so, the maximum water is reabsorbed in PCT whether vasopressin is present or not.

42. c) 50 mOsm/L

(Ref. Ganong's Physiology 25th edition. page. 680).

Explanation- Urine osmolality in humans may b e as low as 30mOsm/kg of H20 and the maximum osmolality of urine can be 1400 mOsm/kg H20.

43. b) Inner medulla

(Ref. Ganong's Physiology 25th edition. page 686).

Explanation- There is a gradient of osmolality from cortex to tip of medulla.

44. a) At the LOH, there is counter current multiplier

(Ref. Ganong's Physiology 25th edition. page 686).

Explanation- The counter current mechanism is a urine concentrating mechanism that operates in renal medulla.

45. b) Reabsorption of Na+ in TAL of LOH

(Ref. Guyton's Physiology 12th edition. page. 351, 13th edition, page 483).

Explanation- Renal medullary hyperosmolarity is due to active reabsorption of Na+ along with co- transport of Cl-, K+ and other ions out of the TAL into the medullary interstitium. Active transport of ions from CD into the medullary interstitium. Facilitated diffusion of large amounts of urea from the inner medullary collecting duct into the medullary interstitium. Little or no reabsorption of water from medullary tubules into the medullary interstitium.

46. d) ECF volume contraction

(Raff's Medical Physiology A Systems Approach, 2011, page 464).

Explanation- ECF volume contraction is a potent stimulus for ADH release, and aldosterone secretion. Both of which concentrate urine. All other choices will increase ECF volume and will not stimulate ADH and Aldosterone release.

47. c) 500 mL

(Ref. Guyton's Physiology 12th edition. page. 350, 13th edition, page 487).

Explanation- Normal 70 kg human must secrete 600 mOsm of solute each day. As maximal urine concentrating ability is 1200 mOsm/L so the minimal volume of urine that must be secreted, called the obligatory urine volume, will be 600/1200= 0.5L- 500mL.

48. d) Vasa recta

(Ref. Guyton's Physiology 12th edition. page. 351, 13th edition, page 483).

Explanation- Vasa recta is counter current exchanger and not counter current multiplier.

49. a) Thin ascending limb of LO

(Ref. Guyton's Physiology 12th edition. page. 351, 13th edition, page 483).

Explanation- Thin ascending limb of LOH is not a part of counter current multiplier system.

50. d) Vasodilatation

(Ref. Ganong's Physiology 25th edition. page 676).

Explanation- Angiotensin is one of the most potent vasoconstrictor in the body.

51. a) Renin angiotensin system

(Raff's Medical Physiology A Systems Approach, 2011, page 458).

Explanation- Control of Na+ balance is the main mechanism for controlling ECF volume. The main controlling signals come from renal sympathetic nerves and the RAAS.

52. c) Decreased blood pressure

d) Increased sympathetic tone

(Raff's Medical Physiology A Systems Approach, 2011, page 458).

Expkanation- both options c and d are correct and are stimuli for renin secretion but remember that renal hypoperfusion is the most potent stimulus for renin secretion.

53. c) Less than inulin

(Ref. Ganong's Physiology 25th edition. page. 680).

Explanation- If clearance < GFR, then reabsorption must be present, also inulin clearance = GFR.

54. b) Urinary concentration in mg/ ml

(Ref: Ganong's Review of Medical Physiology 24/e p 678)

Explanation- In the given formula of urea clearance,

C is Clearance of substance

U is urinary concentration of substance in mg/ml

P is plasma concentration of substance in mg/ml

V is volume of urine

55. b) Mesangial cell constriction

(Ref: Ganong's Review of Medical Physiology 24/e p707)

Explanation- ANP causes mesangial relaxation and dilatation of afferent arterioles leading to increased glomerular filtration and sodium excretion. It also acts on renal tubules to inhibit sodium reabsorption.

56. c) Eye.

Explanation: Counter current mechanism is seen in kidney (loop of henle and vasa recta), testes, intestine and limbs.

57. a) Decrease in GFR

(Ref: Chapter 27, Guyton & Hall textbook of medical physiology 13th edition, Pg-339)

Explanation-

1. Afferent arteriolar constriction decreases renal plasma flow (RPF) and thus decreases GFR by decreasing hydrostatic pressure of glomerular capillary.

so here, filtration fraction viz GFR/RPF undergoes no change.

2 Constriction of efferent arteriole increases hydrostatic pressure of glomerular capillaries and thereby increases GFR. But this happens only initially. Later, GFR decreases when eff. arteriole constricts to less than critical diameter.

So, effect of efferent arteriole constriction on GFR is BIMODAL.

Option d: osmotic pressure in capillaries increases due to increased filtration fraction, mild efferent arteriolar constriction leads to increase in GFR.

58. b) It consists of type 3 collagen

Explanation- The renal basement membrane contains type IV collagen.

Cardiovascular System – Questions

Q1. Time taken for electrical conduct from SA node to AV node in ECG is –

a. PR interval
b. ST segment
c. QT interval
d. Cannot be determined by ECG

Q2. Parasympathetic nerve supply of heart comes through –

a. Phrenic nerve
b. Spinal accessory nerve
c. Vagus nerve
d. None of the above.

Q3. Absolute refractory period of heart is the gap of time in which-

a. Heart is in diastole
b. Unresponsive to neural stimuli
c. No action potential from another part of heart will re-excite the heart muscle
d. None of the above

Q4. Blood turbulence is increased in which of the following situations-

a. Multiple myeloma
b. Leukemia
c. Polycythemia
d. Anemia

Q5. .....% of the cardiac output flows through the liver-

a. 10 b. 20
c. 30 d. 40

Q6. The greatest drop in systemic arterial blood pressure occurs in –

a. Capacitance vessels
b. Venules
c. Pre-capillary resistance vessels
d. None of the above.

Q7. How much blood goes to brain in a normal healthy conscious individual-

a. Half of total cardiac output
b. 1/4 th of total cardiac output
c. 1/6 th of total cardiac output
d. 1/8 th of total cardiac output

Q8. Pre-Capillary vessels in pulmonary circulations differs from those of systemic circulation is, that in former, they are-

a. Thick walled
b. Thin walled
c. Easily distensible
d. Both a and c are true
e. Both b and c are true

Q9. Autoregulation of blood flow is seen in-

a. Liver b. Muscles
c. Kidneys d. Brain

Q10. Stimulation of baroreceptor leads of-

a. Increase in B.P. and heart rate
b. Decrease in B.P. and heart rate
c. Increased intracranial tension
d. Decreased intracranial tension.

Q11. Vagus inhibits pacemaker potential by all except-

a. Hyperpolarisation
b. Decreased slope of pre potential
c. Stabilising resting membrane potential
d. Increase K^+ permeability

Q12. P-R Interval in the ECG corresponds to-

a. Time interval between onset of atrial contraction and onset of ventricular contraction
b. Time delay in the A-V Node
c. S-A Nodal conduction time
d. Ventricular depolarisation

Q13. Myocardial oxygen demand-

a. Inversely proportional to heart rate
b. Directly proportional to heart rate
c. Increased by digitalis
d. Not related to heart rate

1. a	2. c	3. c	4. d	5. c	6. c	7. d	8. e	9. d	10. b
11. c	12. a	13. b							

Q14. S.A. Node all are true except-
a. Initiates the impulse at faster rate
b. Generate the impulse spontaneously
c. Increased by the parasympathetic activity
d. Increased by sympathetic activity

Q15. The first reactive change to occur after haemorrhage is-
a. Vasoconstriction
b. Tachycardia
c. Raised cortisol
d. Raised adrenaline

Q16. Conduction velocity is least in-
a. AV node b. Bundle of His
c. SA node d. Purkinje fibres

Q17. Sympathetic vasoconstrictor tone is diminished in response increased activity of-
a. Carotid body chemoreceptors
b. Carotid sinus pressure receptors
c. Plain receptors
d. Medullary chemoreceptors

Q18. Direct Fick method of measuring cardiac output requires estimation of–
a. O_2 content of arterial blood
b. O_2 consumption per unit time
c. Arteriovenous O_2 difference
d. All of the above.

Q19. Cardiac cycle duration in man is-
a. 0.4 seconds b. 0.8 seconds
c. 1.2 seconds d. 1.6 seconds

Q20. Dicrotic notch in aortic pressure curve is-
a. Magnified by aortic regurgitaion
b. Absent in arteriosclerosis
c. Of no diagnostic value
d. Coincident with 2nd heart sound

Q21. Under resting condition the cardiac output in L/min is –
a. 2.5 b. 4.25
c. 5.25 d. 9.5

Q22. Cardiac output in L/min divided by heart rate equals-
a. Cardiac efficiency
b. Cardiac index
c. Mean stroke volume
d. Mean arterial pressure.

Q23. Electrocardiographic leads designated V1, V2 etc. refer to-
a. Unipolar limb leads
b. Unipolar chest leads
c. Bipolar limb leads
d. Bipolar chest leads

Q24. The basis of Korot koff ounds is due to–
a. AV valve closure
b. Aortic valve closure
c. Arterial expansion
d. Arterial turbulence

Q25. What increases the stroke work done by left ventricle-
a. Systemic hypertension
b. Increased sympathetic tone in heart
c. Aortic stenosis
d. All of the above

Q26. Patient with anaemia tends to have all except-
a. Compensatory increase in cardiac output
b. Increased incidence of heart mumurs
c. Pallor of mucous membrane
d. A low PO_2 in arterial blood

Q27. Vascular distensibility is least for the following vascular segment-
a. Pulmonary artery
b. Systemic artery
c. Systemic vein
d. Pulmonary vein

Q28. Pulse pressure in a particular vessel is determined chiefly by-
a. Distance from heart
b. Frictional characteristic lumen
c. Distensibility
d. Cross sectional area

Q29. Work performed by the left ventricle is greater than that performed by the right ventricle due to difference in-
a. Blood velocity
b. Stroke volume
c. Arterial pressures
d. Atrial pressures

14. c	15. a	16. a	17. b	18. d	19. b	20. d	21. c	22. c	23. b
24. d	25. d	26. d	27. b	28. c	29. c				

Q30. Fibres of A-V junction-
a. Modified muscle fibres
b. Modified nerve fibres
c. Highly contactile
d. Conduct impulse rapidly

Q31. The arterial pulse pressure in the femoral artery is normally-
a. Less than the pulse pressure in the upper aorta
b. Less than 20 mm Hg
c. Greater than the pulse pressure in the upper aorta
d. Equal to the pressure in the upper aorta

Q32. Absolute refractory period in heart-
a. Lasts till cardiac contraction
b. Longer than refractory period in skeletal muscle
c. A phase of cardiac cycle in which heart cannot be stimulated by any amount of stimulus
d. All of the above

Q33. The second heart sound differs from first heart sound in that-
a. Is occasionally split
b. Has higher frequency
c. Duration greater than first sound
d. Due partly to turbulence set up by valve closure

Q34. A decrease in the velocity of impulse conduction through the A-V node will usually cause-
a. The PQ interval to increase
b. The PQ interval to decrease
c. Disappearance of the T-wave
d. Increased heart rate

Q35. Weightlessness result in-
a. Decreased cardiac output
b. Hypotension
c. Osteoporosis
d. All of the above

Q36. Repolarization of ventricular muscle-
a. Occurs last at apex
b. Begins in septum
c. Begins in epicardium
d. Begins at AV node

Q37. Velocity of blood flow is inversely proportional to –
a. Viscosity
b. Flow
c. Cross-sectional area
d. Length

Q38. Which of the following is wrongly matched about ECG waves and their duration-
a. P wave-0.10 sec
b. S wave-0.04 sec
c. QRS complex- max 0.10 sec
d. Q wave- 0.10 sec

Q39. Right and left vagus respectively go to –
a. SA node, AV node
b. AV node, SA node
c. AV node, bundle of His
d. SA node, bundle of His

Q40. The resistance of a blood vessel is 16 PRU. Doubling the vessel diameter would change the resistance to –
a. 1 PRU b. 2 PRU
c. 8 PRU d. 12 PRU

Q41. Severe hypoxia may produce-
a. Bp rise
b. Bp fall
c. Fall followed by Bp rise
d. No change

Q42. Respiratory quotient of cerebral tissue is-
a. 0.75-0.95 b. 0.95-0.99
c. 1.0-1.1 d. 1.1-1.2

Q43. The organ with maximum O_2 consumption per minute at rest is-
a. Liver
b. Brain
c. Skeletal muscle
d. Heart

Q44. Cardiac index, in L/sq. mt. of body surface area, in a normal person is-
a. 2.1 b. 3.2
c. 4.6 d. 5.9

Q45. Heart sound heard immediately before the first heart sound when atrial pressure is high-
a. First b. Second
c. Third d. Fourth

30. a	31. a,b	32. d	33. b	34. a	35. d	36. c	37. c	38. d	39. a
40. a	41. a	42. b	43. a	44. b	45. d				

Q 46. Baroreceptors mainly act through-
a. Sympathetic system
b. Parasympathetic system
c. Cerebral cortex
d. Blood volume

Q47. In athletes bradycardia is because of–
a. Decreased sympathetic tone
b. Increased vagal tone
c. Cardiac output
d. Low venous return

Q48. All of the following factors cause an increase in cardiac output except-
a. Pregnancy in late stages
b. Exercise
c. Eating
d. Standing from lying position

Q49. During exercise, blood flow does not decrease in-
a. Cutaneous circulation
b. Hepatosplanchnic circulation
c. Coronary circulation
d. Renal circulation

Q50. Venous return (VR) is given by formula-
a. VR = Resistance to Venous Return – Rt Atrial Pressure
Mean Systemic Filling Pressure
b. VR = MSFP – RVR RAP
c. VR = MSFP – RAP RVR
d. None

Q51. Most potent stimulus for vaso constriction is-
a. Cerebral hypoxia
b. Decrease in renal perfusion
c. Decrease in cardiac Perfusion
d. Decrease in skeletal muscle perfusion
e. None of the above

Q52. Ejection fraction of the ventricle refers to the ratio of –
a. Amount of blood received/amount of blood ejected
b. Stroke volume/end-diastolic volume
c. End-systolic volume / end-diastolic volume
d. Stroke volume/end-systolic volume

Q53. Carotid sinus afferents pass through-
a. IX nerve b. X nerve
c. V nerve d. VII nerve

Q54. Carotid sinus stimulation would result in-
a. Decreased vagal activity
b. Increased heart rate
c. Decreased sympathetic discharge to heart
d. Increased vasomotor tone

Q55. Repolarization in isolated muscle piece fibre proceeds from-
a. Epicardium to endocardium
b. Endocardium to epicardium
c. Left to right
d. Right to left

Q56. The cardiac output can be determined by all except-
a. Fick's principle
b. V/Q ratio
c. Echocardiography
d. Thermodilution

Q57. Maximum surface area is present in-
a. Capillary b. Arterioles
c. Artery d. Vein

Q58. Hypovolemic shock is characterized by all of the following except-
a. Hypotension
b. Cold and clammy skin
c. Intense thirst
d. Tachycardia
e. Inhibition of respiration

Q59. Ejection fraction increases with increase in-
a. End systolic volume
b. End diastolic volume
c. Peripheral vascular resistance
d. Venodilation

Q60. Carotid body baroreceptor is most sensitive to –
a. Mean blood pressure
b. Diastolic blood pressure
c. Systolic blood pressure
d. Pulse pressure

46. a	47. b	48. d	49. c	50. c	51. a	52. b	53. a	54. c	55. b
56. b	57. a	58. e	59. b	60. d					

Q61. Occlusion of common carotid artery on both sides leads to –

a. Increase in HR & BP
b. Increase in BP & decrease in HR
c. Decrease in HR & BP
d. No effect on BP & HR.

Q62. Heart rate increase with one of the following-

a. Stimulation of trigeminal nerve pain receptor
b. Increased intracranial tension
c. Decreased stimulation of Baroreceptors
d. Increased parasympathetic stimulation

Q63. If the blood flow through a blood vessel is 1 ml/min, how much will it become if its radius is doubled-

a. Will remain the same
b. 4 ml/min
c. 8 ml/min
d. 16 ml/min.

Q64. The pre- depolarization phase of the SA node Action potential is due to :

a. K^+ entry
b. Ca^{++} entry
c. Na^+ entry towards the end of repolarization
d. Cl^- efflux

Q65. Compensatory mechanism in a patient with hypovolemic shock

a. Increased renal blood flow
b. Decrease in cortisol
c. Decrease in vasopressin
d. Decreased cutaneous blood flow

Q66. Which of the following shows prepotential followed by action potential:

a. Ventricles
b. Papillary muscle
c. Purkinje fibres
d. Chordae tendini

Q67. Equilibrium pressure in the absence of flow is called :

a. Mean circulatory filling pressure
b. Critical closing pressure
c. Perfusion pressure
d. Pulse pressure

Q68. Serious complication of prolonged sitting posture :

a. Dysarrythmia
b. Hypotension
c. Nerve paralysis
d. Venous embolism

Q69. Parasympathetic nerve supply of heart comes through-

a. Phrenic nerve
b. Spinal accessory nerve
c. Vagus nerve
d. None of the above

Q70. Following acute failure of the left ventricle, pulmonary edema generally begins to appear when left atrial pressure approaches –

a. 7 mm Hg b. 15 mm Hg
c. 20 mm Hg d. 30 mm Hg
e. 50 mm Hg

Q71. Absent P waves with wide QRS complex indicates serum potassium of :

a. 5.4 meq/L
b. 6.5meq/L
c. More than 8 meq/L
d. More than 10 meq/L

Q72. Aortic valve closure corresponds to beginning of :

a. Systole
b. Parasystole
c. Isovolumetric relaxation
d. Isovolumetric contraction

Q73. The oxygen consumption in the arrested asystolic heart is :

a. 10 ml/min
b. 100 ml/min
c. 2 ml/min/100 gm
d. 30ml/min
e. None of the above

Q74. The percentage of the circulating blood volume in the venous system and splanchnic vessels is normally between :

a. 20-30% b. 40-50%
c. 60-70 % d. None of the above

61. a	62. c	63. d	64. c	65. d	66. c	67. a	68. d	69. c	70. c
71. c	72. c	73. c	74. c						

Q75. Normal blood pH is :

a. 7.20 b. 7.30
c. 7.40 d. 7.70
e. 7.10

Q76. Upto what systolic pressure is the brain capable of autoregulation :

a. 65 mm of Hg b. 55 mm of Hg
c. 45 mm of Hg d. 75 mm of Hg

Q77. What is not true for extrasystole in ventricle :

a. Fails to produce radial pulse
b. Hints at serious heart ailment
c. Associated with abnormal QRS complex
d. Tendency to be followed by a compensatory pause

Q78. What prevents blood loss after rupture of a small blood vessel :

a. Vasocontriction
b. Formation of fibrin thread
c. Formation of platelet plug
d. Production of haematoma to increased perivascular pressure
e. All of the above

Q79. First component of first heart sound is usually clearly heard on ventral surface of chest at :

a. 2nd intercostals space to right of sternum
b. 2nd intercostals space to left of sternum
c. 5th intercostals space to left or sternum
d. 5th intercostals space over sternum

Q80. Calculate the peripheral resistance in Wood Units, if the cardiac output is 5 L/min, MAP is 90 mm Hg and the right atrial pressure is 0 mm Hg:

a. 12 b. 14
c. 16 d. 18

Q81. Coronary blood flow stops during :

a. Protodiastole
b. End of diastole
c. Isometric relaxation
d. Isovolumetric contraction

Q82. Arteriolar dilatation is caused by all of the following except :

a. Decrease in adrenergic discharge
b. Histamine
c. Substance P
d. Serotonin

Q83. Tachycardia at the onset of exercise to stimulation of :

a. Chemoreceptors
b. Baroreceptors
c. Stretch receptors
d. Joint proprioceptors

Q84. Capillaries with tight junction allowing the passage of only small molecules are found in :

a. Brain b. Skin
c. Kidney d. Muscle

Q85. During exercise which of the following circulations experience the least change in blood flow:

a. Brain b. Heart
c. Skeletal muscle d. GIT

Q86. Splanchnic circulation in vigorous activity is affected by :

a. Decrease blood supply due to vasoconstriction
b. Decreases blood supply due to venoconstriction
c. Decrease capacitance with shunting of blood
d. Increase capillary congestion

Q87. All are increased during exercise except :

a. Cardiac output
b. Venous return
c. Coronary blood flow
d. Peripheral vascular resistance

Q88. Pre-capillary sphincter relaxation is caused by :

a. Local metabolites
b. Circulating catecholamines
c. Sympathetic activity
d. Fall in capillary pressure

Q89. Occlusion of common carotid artery of both sides leads to :

a. Increase in HR & BP
b. Increase in BP & decrease in HR
c. Decrease in HR & BP
d. No effect on BP & HR

75. c	76. a	77. b	78. e	79. c	80. d	81. d	82. d	83. d	84. a
85. a	86. c	87. d	88. a	89. c					

Q90. Physiological changes during severe exercise are :

a. Hyperventilation
b. Hyperkalemia
c. ↓ed Pa O_2
d. ↓ed Pa CO_2
e. ↑ed H_2CO_3

Q91 Carotid sinus massage causes :

a. Hyperapnea
b. Reflex bradycardia
c. Tachycardia
d. Dyspnea

Q92. Blood pressure is defined as the product of :

a. Systolic pressure x pulse
b. Diastolic pressure x pulse rate
c. Pulse pressure x pulse rate
d. Cardiac output x peripheral resistance

Q93. In exercising muscle; true about metabolism is :

a. same in aerobic and anaerobic
b. Fatty acids used mainly
c. Glycogen and creatine kinase used anerobically
d. All of the above

Q94. Volume determining preload is:

a. End diastolic volume of ventricles
b. End systolic volume
c. Volume of blood in aorta
d. Ventricular ejection volume

Q95. The pressure volume loop is shifted to the left in :

a. Mitral regurgitation
b. Aortic regurgitation
c. Mitral stenosis
d. Aortic stenosis

Q96. Bernoulli's principle states :

a. Sum of kinetic energy of flow and pressure energy is constant
b. Low tones producing maximal stimulation at apex of cochlea
c. Magnitude of the sensation felt is proportionate to the intensity of stimulus
d. Force of contraction is proportional to the stretch of cardiac muscle

Q97. Laminar flow is dependent on :

a. Critical velocity
b. Viscosity
c. Constant velocity
d. Critically closing pressure

Q98. AV nodal delay is :

a. 0.1 sec b. 0.2 sec
c. 0.3 sec d. 0.4 sec

Q99. The pacemaker potential is due to :

a. Fast Na+ channel
b. Decrease in K+ permeability
c. Slow Ca++ channel
d. Rapid repolarization

Q100. Two students Vincent and kamlesh were asked to demonstrate in dogs the role of sinus nerve in hypovolemic shock. Vincent severed the sinus nerve when the mean blood pressure (MBP) 85 mm Hg and Kamlesh cut the sinus nerve when the mean blood pressure was 60 mm Hg. On cutting the sinus nerve :

a. Vincent recorded the increasing MBP but kamlesh recorded a decrease in MBP
b. Vincent recorded a decrease in MBP but kamlesh recorded in increase in MBP
c. Both recorded an increase in MBP
d. Both recorded a decrease in MBP

Q101. Calcium enters the cardiac cell during :

a. Rapid upstroke of the action potential
b. Down slope of the action potential
c. Plateau phase of the action potential
d. Slow diastolic depolarization (phase 4) of the action potential

Q102. Blood pressure in right ventricle :

a. 25 mmHg b. 80 mmHg
c. 95 mmHg d. 120 mmHg

Q103. A patient exhibits swelling of the ankles and a bloated abdomen and has a history of malnutrition . The bloated abdomen is probably caused by :

a. Increased intestinal gas
b. Slow chronic abdominal hemorrhage
c. Increased capillary hydrostatic pressure

90. a,b,d	91. b	92. d	93. c	94. a	95. c	96. a	97. a	98. a	99. b
100. a	101. c	102. a	103. d						

d. Decreased capillary colloid osmotic pressure

Q104. All of the following factors normally increase the length of the ventricular cardiac muscle fibers except :

a. Increased venous tone
b. Increased total blood volume
c. Increased negative intrathoracic pressure
d. Change in posture- lying to standing

Q105. Which one of the following is not a transport or binding protein :

a. Erythropoietin b. Ceruloplasmin
c. Lactoferrin d. Transferrin

Q106. A pilot in sukhol aircraft is experiencing negative G. Which of the following physiological events manifest in such situation :

a. The hydrostatic pressure in veins of lower limb increases
b. The cardiac output decreases
c. Black out occurs
d. The cerebral arterial pressure rises

Q107. Which of the following is expected to increase in response to hemorrhage:

a. Arteriolar diameter in skeletal muscle
b. Sympathetic activity
c. Sodium excretion
d. Water excretion

Q108. Poiseuille's law is-

a. Flow = $\frac{(P_A - P_B)\ \pi r^4}{8\eta L}$

b. Flow = $\frac{(P_A \times P_B)\ \pi r^4}{8\eta}$

c. Flow = $\frac{(P_A + P_B)\ \pi r^4}{8\eta}$

d. Flow = $\frac{(P_A / P_B)\ \pi r^4}{8\eta L}$

Q109. Laplace's law , all except

a. P= T/r b. P =2T/r
c. T=Pr/w d. T= wP/r

Q110. Plateau phase of cardiac muscle is due to :

a. Fast Na^+channel opening
b. Opening of Na^+ channel
c. Opening of slow Ca^{++} channels
d. Opening of K^+ channels

Q111. The fourth heart sound is caused by:

a. Closure of the aortic and pulmonary valves
b. Vibrations in the ventricular wall during systole
c. Ventricular filling
d. Closure of the mitral and tricuspid valves

Q112. True about cardiac O_2 demand is :

a. Directly pyoportional to mean arterial pressure
b. Inversely proportional to heart rate
c. Inversely proportional to cardiac work
d. Has a constant relation to the external work done by the heart

Q113. In a normal person which of the following occurs when he changes from standing to supine position:

a. Cerebral perfusion increase
b. Heart rate settles to a higher level
c. Immediate increase in venous return
d. Decreased perfusion to the apex

Q114. Which of the following statement is least correct :

a. Vagal stimulation decreases rate of contraction
b. Noradrenalin increases forces of contraction
c. Denervated heart has more heart rate
d. During exercise systole is shortened more than diastole

Q115. What is the effect of moderate exercise on cerebral blood flow?

a. Does not change
b. Increases
c. Decreases
d. Intially increases and then decreases

Q116. In standing position, venous return to heart from lower limbs is affected by all of the following except-

a. Competant valves
b. Deep fascia
c. Arterial pressure
d. Contraction of calf muscles

104. d	105. a	106. d	107. b	108. a	109. d	110. c	111. c	112. a	113. c
114. d	115. a	116. c							

Q117. Cerebral blood flow is regulated by all except-

a. Blood pressure
b. Arterial PCO_2
c. Potassium ions
d. Cerebral blood flow
d. Venous pressure

Q118. CSF pressure is mainly regulated by-

a. Rate of CSF formation
b. Rate of CSF absorption
c. Cerebral blood flow
d. Venous pressure

Q119. About CSF following statement(s) is /are true-

a. Specific gravity is 1.003-1.0008
b. Specific gravity is 1.0003-1.0008
c. Total volume of CSF is 150 ml
d. Daily production is 550ml/day
e. Daily production is 1500ml/day

Q120. During diastole, the arterial pressure is maintained by-

a. Elastic recoil of aorta
b. Musculature of artries
c. Constriction of capillaries
d. Contraction of left Ventricle

Q121. Which of the following statements about cutaneous shunt vessels is true-

a. Perform nutritive function
b. Have role in thermoregulation
c. Not under the control of autonomic nervous system
d. These vessels are evenly distributed throughout the skin

Q122. The positive chronotropic action of epinephrine is due to all of the following effects on cardiac action potential, except-

a. Increase in the rate of rise of phase zero
b. Increase in the rate of repolarization in phase one
c. Shortening of phase two
d. Increase in the rate of repolarization of phase three

Q123. Which of the following is not a measure of stroke volume?

a. Left ventricular end diastolic volume minus left ventricular end systolic volume
b. Ejection fraction times left ventricular end diastolic volume
c. Ejection fraction times cardiac output
d. Cardiac output/ heart rate

Q124. During heavy exercise the cardiac output (CO) increases upto five fold while pulmonary arterial pressure rises very little. This physiological ability of the pulmonary circulation is best explained by-

a. Increase in the number of open capillaries
b. Sympathetically mediated greater distensibility of pulmonary vessels
c. Large amount of smooth muscle in pulmonary arterioles
d. Smaller surface area of pulmonary circulation

Q125. Low pressure receptors that respond to changes in blood volume and play role in arterial pressure regulation are located in-

a. Left Atrium
b. Right Atrium
c. Pulmonary arteries
d. All of above

Q126. The Primary action of Nitric oxide (NO) in the gastrointestinal tract is-

a. Vasodilatation
b. Vasoconstriction
c. Gastrointestinal smooth muscle relaxation
d. Gastrointestinal slow smooth muscle contraction

Q127. All are effects of sympathetic stimulation except-

a. Increased conduction velocity
b. Increased heart rate
c. Increased refractory period
d. Increased contractility of heart

117. a	118. b	119. a,c,d	120. a	121. b	122. c	123. c	124. a	125. d
126. c	127. c							

Q128. Volume receptors are –

a. Affected by total cardiovascular output
b. Stimulated by atrial systole and diastole
c. Stimulated by left ventricular contraction
d. Stimulated by aortic pressure

Q129. Starlings law implies :

a. Increased VR - increased CO
b. Increased discharge - increased CO
c. Increased HR - increased CO
d. Increased BP- increased CO

Q130. Isometric relaxation is defined as:

a. Relaxation of both atria
b. Relaxation of both atria with all valves open
c. Relaxation of LV with mitral & aortic valve closed
d. Relaxation of LV with mitral & aortic valve open

Q131. Windkessel effect is seen in :

a. Large elastic vessels
b. Capacitance vessels
c. Throughfare channel
d. Capillaries

Q132. On increasing vagal tone which of the following is seen:

a. Increased K^+efflux, increased slopeof phase 4
b. Decreased K^+efflux, decreased slopeof phase 4
c. Increased K^+efflux, decreased slope of phase 4
d. Decreased K^+ efflux, increased slopeof phase 4

Q133. Gatekeeper of the heart is :

a. SA node
b. AV node
c. Purkinje fibers
d. Bundle of his

Q134. Highest compliance is seen in which vessel:

a. Arteries b. Veins
c. Aorta d. Capillaries

Q135. What is normal left ventricular ejection fraction :

a. 20% b. 30%
c. 50% d. 65%

Q136. Brain blood supply

a. 55 ml/100 gm/min
b. 400 ml/ 100 gm /min
c. 100ml/ 100 gm/ min
d. 200 ml/ 100gm/ min

Q137. All are vasodilators except :

a. Prostacyclin b. NO
c. Bradykinin d. Endothelin

Q138. Ventricular filling is followed by:

a. Isovolumetric relaxation
b. Isovolumetric contraction
c. Peripheral resistance
d. Parasympathetic nervous system activation

Q139. Cardiac output is increased in :

a. Sleep b. Pregnancy
c. Sitting d. Standing

Q140. Normal duration of PR interval :

a. 0.12- 0.2 sec b. 0.2- 0.3 sec
c. 0.3- 0.4 sec d. 0.4-0.5 sec

Q141. Prepotential phase in the SA node is due to all except :

a. Ca^{2+} spark
b. Fast sodium channels opening
c. K^+ decay
d. Transient Ca channel opening

Q142. The blood pressure regulatory system that is also known as a buffer system is :

a. Baroreceptor
b. Chemoreceptor
c. Kidney
d. CNS ischemic response

Q143. The primary cause for the development of shock following hemorrhage is :

a. Marked vasodilation
b. Decreased blood volume
c. Inadequate output by the heart
d. Obstruction to blood flow

128. b	129. a	130. c	131. a	132. b	133. b	134. b	135. d	136. a
137. d	138. b	139. b	140. a	141. b	142. a	143. b		

Q144. Atrioventricular nodal delay is due to :

a. Less gap junction
b. More tight junctions
c. Intercalated discs
d. Prolonged refractory period

Q145. During shock which organ is spared from vasoconstriction :

a. Skin b. Heart
c. Kidney d. Liver

Q146. Normal portal venous pressure is:

a. 5-10 mm Hg b. 10-15 mm Hg
c. 15-20 mm Hg d. 20-35 mm Hg

Q147. Mean arterial pressure is :

a. Artithmetic mean of systolic and diastolic pressure
b. Longarithmic mean of systolic and diastolic pressure
c. 40% diastolic + 60% systolic
d. 60% diastolic + 40% systolic

Q148. While getting blood pressure tested patient reports abnormal feeling in finger tips followed by involuntary spasm of fingers. The patient likely has :

a. Hysterical spasms
b. Pressure spasm of muscle due to neuropaxia
c. Hypocalcemic tetany
d. Ischemic muscle spasm

Q149. The cardiovascular parameter which is best indicator of vagal tone:

a. Heart rate
b. Stroke volume
c. Ejoction fraction
d. Diastolic pressure

Q150. During mild to moderate exercise, increase in heart rate decreases the cardiac cycle time. The change that is most commonly seen is :

a. There is greater decrease in arterial systole than atrial diastole
b. There is greater decrease in ventricular systole than ventricular diastole
c. There Is greater decrease in ventricular diastole than ventricular systole
d. None of the above

Q151. Deoxygenated blood is not seen in :

a. Pulmonary artery
b. Pulmonary vein
c. Right atrium
d. Umbilical artery

Q152. EDRF is :

a. NO_2 b. NO
c. N_2O d. SO_2

Q153. Major portion of coronary blood flow occur during

a. Systole
b. Diastole
c. Not related to phase
d. It is variable

Q154. All are cardiovascular effect of parasympathetic stimulation except:

a. Decreased heart rate
b. Decreased conduction
c. Increased automaticity
d. Increased refractive period

Q155. Slowest rate of blood flow is seen in :

a. Arteriole b. Veins
c. Capillaries d. Venules

Q156. Swan Ganz Catheter is used to measure :

a. Mean arterial pressure
b. Cardiac output
c. Blood volume
d. Pulmonary capillary wedge pressure

Q157. Cushing's phenomenon is :

a. Low BP & high heart rate
b. High BP & high heart rate
c. Low BP & low heart rate
d. High BP & low heart rate

144. a	145. b	146. a	147. d	148. c	149. a	150. c	151. b	152. b
153. b	154. c	155. c	156. d	157. d				

Q158. SI unit of pressure is :

a. mmHg b. cmHg
c. Pascal d. Torr

Q159. Bradycardia seen in patients with raised intracranial pressure is :

a. Cushing reflex b. Cushing disease
c. Starling reflex d. Gometz reflex

Q160. A wave in JVP is due to :

a. Atrial contraction
b. Ventricular filling
c. Atrial filling
d. Bulging of tricuspid valve in right atrium

Q161. Healthy adult cardiac reserve is:

a. 50-100% b. 100-200%
c. 200-250 % d. 300-400%

Q162. Which of the following statements about vasomotor centre (VMC) is true-

a. Independent of corticohypothalamic inputs
b. Influenced by baroceptor signals but not by chemoreceptors
c. Acts along with the cardiovagal centre (CVC) to maintain blood pressure
d. Essentially silent in sleep.

Cardiovascular System – Explanations

1. a) PR interval

(Ref. Ganong's Physiology 24th edition – pp- 494).

2. c) Vagus nerve

(Ref. Ganong's Physiology 24th edition – pp- 520).

3. c) No action potential from another part of heart will re-excite the heart muscle

(Ref- Guyton Physiology 13th edition- page 111).

Explanation- The refractory period of the heart is the interval of time, , during which a normal cardiac impulse cannot re-excite an already excited area of cardiac muscle. The normal refractory period of the ventricle is 0.25 to 0.30 second, which is about the duration of the prolonged plateau action potential.

4. d) Anemia

(Ref. Ganong's Physiology 25th edition – pp- 574).

Explanation- **POISEUILLE-HAGEN FORMULA** The relationship between the flow in a long narrow tube, the viscosity of the fluid, and the radius of the tube is expressed mathematically in the Poiseuille-Hagen formula: since blood flow is inversely proportional to viscosity – and in anemia – viscosity decreases so blood flow increases and becomes turbulent. In remaining three choices, viscosity increases so blood flow decreases.

5. c) 30

(Ref. Ganong's Physiology 25th edition – pp- 602, Table).

6. c) Pre-capillary resistance vessels

(Ref. Ganong's Physiology 25th edition – pp- 576).

Explanation- The pressure falls very slightly in the large- and medium-sized arteries because their resistance to flow is small, but it falls rapidly in the small arteries and arterioles, which are the main sites of the peripheral resistance against which the heart pumps. The mean pressure at the end of the arterioles is 30-38 mmHg.

7. d) 1/8 th of total cardiac output

(Ref. Ganong's Physiology 25th edition – pp- 602, Table).

8. e) Both b and c are true

(Ref. Ganong's Physiology 25th edition – pp- 635).

Explanation- The pulmonary vascular bed resembles the systemic one, except that the walls of the pulmonary artery and its large branches are about 30% as thick as the wall of the aorta, and the small arterial vessels, unlike the systemic arterioles, are endothelial tubes with relatively little muscle in their walls. The walls of the postcapillary vessels also contain some smooth muscle

9. d) Brain

(Ref. Ganong's Physiology 25th edition – pp- 607).

Explanation- Autoregulation is prominent in the brain. This process, by which the flow to many tissues is maintained at relatively constant levels despite variations in perfusion pressure. In the brain, autoregulation maintains a normal cerebral blood flow at arterial pressures of 65–140 mm Hg.

10. b) Decrease in B.P. and heart rate

(Ref. Ganong's Physiology 24th edition – pp- 559).

Explanation- Baroreceptor stimulation inhibits vasomotor center and stimulates cardiovagal center.So, sympathetic system will be inhibited and parasympathetic system will be stimulated.

11. c) Stabilising resting membrane potential

(Ref. Ganong's Physiology 25th edition – pp- 521).

Explanation- When the cholinergic vagal fibers to nodal tissue are stimulated, the membrane becomes hyperpolarized and the slope of the prepotentials is decreased because the acetylcholine released at the nerve endings increases the K+ conductance of nodal tissue. This action is mediated by M2 muscarinic receptors, which, via the βγ subunit of a G protein, open a special set of K+ channels

12. a) Time interval between onset of atrial contraction and onset of ventricular contraction

(Ref. Ganong's Physiology 25th edition – pp- 524 Table 29.-2).

13. b) Directly proportional to heart rate

(Ref. Guyton's Physiology 13rd edition, pp 260).

Explanation- Blood flow in the coronary arteries usually is regulated almost exactly in proportion

to the need of the cardiac musculature for oxygen. Normally, about 70 percent of the oxygen in the coronary arterial blood is removed as the blood flows through the heart muscle.

14. c) Increased by the parasympathetic activity

SA node rate of discharge will be decreased by para-sympathetic activity.

15. a) Vasoconstriction

(Ref- Guyton Physiology 13th edition- page 211).

Explanation- However, experiments have shown that the concentration of circulating blood vasopressin after severe haemorrhage can increase enough to raise the arterial pressure as much as 60 mm Hg.

16. a) AV node

(Ref. Ganong's Physiology 25th edition – pp-520).

Explanation- Compared with Purkinje fibers, cells within the SA node and, to a lesser extent, the AV node are smaller and sparsely striated and are less conductive due to their higher internal resistance.

17. b) Carotid sinus pressure receptors

(Ref. Ganong's Physiology 24th edition – pp- 559).

Explanation- Baroreceptor stimulation inhibits vasomotor center and stimulates cardiovagal center. So, sympathetic system will be inhibited and parasympathetic system will be stimulated.

18. d) All of the above.

(Ref. Ganong's Physiology 24th edition – pp- 543).

19. b) 0.8 seconds

(Ref- Guyton Physiology 13th edition- page 113).

Explanation- The total duration of the cardiac cycle, including systole and diastole, is the reciprocal of the heart rate. For example, if heart rate is 72 beats/min, the duration of the cardiac cycle is 1/72 min/beat—about 0.0139 minutes per beat, or 0.833 second per beat.

20. d) Coincident with 2nd heart sound

(Ref. Ganong's Physiology 25th edition – pp- 540,1,2).

Explanation- The dicrotic notch, a small oscillation on the falling phase of the pulse wave caused by vibrations set up when the aortic valve snaps shut, is visible if the pressure wave is recorded but is not palpable at the wrist. The pulmonary artery pressure curve also has a dicrotic notch produced by the closure of the pulmonary valves.

21. c) 5.25

(Ref. Ganong's Physiology 25th edition – pp- 544).

Explanation- The output of the heart per unit of time is the cardiac output. In a resting, supine man, it averages about 5.0 L/min (70 mL × 72 beats/min). There is a correlation between resting cardiac output and body surface area.

22. c) Mean stroke volume

(Ref. Ganong's Physiology 25th edition – pp- 544).

23. b) Unipolar chest leads

(Ref. Ganong's Physiology 25th edition – pp- 524).

24. d) Arterial turbulence

(Ref. Ganong's Physiology 25th edition – pp- 540).

Explanation- Constriction of an artery increases the velocity of blood flow through the constriction, producing turbulence and sound beyond the constriction.

25. d) All of the above

(Ref. Ganong's Physiology 25th edition – pp- 550).

Explanation- Since work done = P x dV, all of the above conditions increase the work ddone, Ventricular work per beat correlates with O2 consumption. The work is the product of stroke volume and mean arterial pressure in the pulmonary artery or the aorta (for the right and left ventricle, respectively). Because aortic pressure is seven times greater than pulmonary artery pressure, the stroke work of the left ventricle is approximately seven times the stroke work of the right.

26. d) A low PO_2 in arterial blood

(Ref. Ganong's Physiology 24th edition – pp- 621 – figure).

27. b) Systemic artery

(Ref- Guyton Physiology 13th edition- page 179).

Explanation- The walls of the arteries are thicker and far stronger than those of the veins. Consequently, the veins, on average, are about eight times more distensible than the arteries. That is, a given increase in pressure causes about eight times as much increase in blood in a vein as in an artery of comparable size.

In the pulmonary circulation, the pulmonary vein distensibilities are similar to those of the systemic circulation. However, the pulmonary arteries normally operate under pressures about one sixth of those in the systemic arterial system, and their distensibilities are correspondingly greater—about six times the distensibility of systemic arteries.

28. c) Distensibility

(Ref- Guyton Physiology 13th edition- page 180,81).

Explanation- Two major factors affect the pulse pressure: (1) the stroke volume output of the heart and (2) the compliance (total distensibility) of the arterial tree. A third, less important factor is the character of ejection from the heart during systole.

29. c) Arterial pressures

(Ref. Ganong's Physiology 25th edition – pp- 550).

Explanation- The work is the product of stroke volume and mean arterial pressure in the pulmonary artery or the aorta (for the right and left ventricle, respectively). Because aortic pressure is seven times greater than pulmonary artery pressure, the stroke work of the left ventricle is approximately seven times the stroke work of the right.

30. a) Modified muscle fibres

(Ref- Guyton Physiology 13th edition- page 110).

Explanation- Instead, they are conducted only by way of a specialized conductive system called the *A-V bundle,* a bundle of conductive fibers several millimeters in diameter.

31. a) Less than the pulse pressure in the upper aorta
& b) Less than 20 mm Hg

32. d) All of the above

(Ref- Guyton Physiology 13th edition- page 111).

33. b) Has higher frequency

(Ref. Ganong's Physiology 24th edition – pp- 512).

34. a) The PQ interval to increase

(Ref- Guyton Physiology 13th edition- page 131).

35. d) All of the above

(Ref- Guyton Physiology 13th edition- page 568).

Explanation- The observed effects of a prolonged stay in space are the following: (1) decrease in blood volume, (2) decrease in red blood cell mass, (3) decrease in muscle strength and work capacity, (4) decrease in maximum cardiac output, and (5) loss of calcium and phosphate from the bones, as well as loss of bone mass.

36. c) Begins in epicardium

(Ref. Comprehensive Textbook of Medical Physiology by GK Pal 1st edition pp 606).

Explanation- The process of repolarization of ventricular muscle occurs in reverse direction. That means epicardial surface repolarizes first and septum and endocardial surface last.

37. c) Cross-sectional area

(Ref. Ganong's Physiology 24th edition – pp- 540).

Explanation- The average velocity of fluid movement at any point in a system of tubes in parallel is inversely proportional to the total cross sectional area at that point.

38. d) Q wave- 0.10 sec

(Ref. Ganong's Physiology 25th edition – pp- 524 – Table 29.2).

39. a) SA node, AV node

(Ref. Guyton's Physiology 13th edition – pp- 120- Fig.9.13).

40. a) 1 PRU

(Ref. Ganong's Physiology 25th edition – pp-571).

Explanation- Since R is inversely proportional to 4th power of radius – doubling the diameter means that radius has been doubled so resistance will reduce by 1/16 times ie. becomes 1 R.

41. a) Bp rise

(Ref. Ganong's Physiology 25th edition – pp- 589 – Table32.2).

42. b) 0.95-0.99

(Ref. Ganong's Physiology 25th edition – pp- 609).

Explanation- Glucose is taken up from the blood in large amounts, and the RQ (respiratory quotient) of cerebral tissue is 0.95–0.99 in normal individuals.

43. a) Liver

(Ref. Ganong's Physiology 25th edition – pp- 602– Table33.1).

44. b) 3.2

(Ref. Ganong's Physiology 24th edition – pp- 512).

45. d) Fourth

(Ref. Ganong's Physiology 25th edition – pp- 542).

Explanation- A fourth sound can sometimes be heard immediately before the first sound when atrial pressure is high or the ventricle is stiff in conditions such as ventricular hypertrophy. It is due to ventricular filling and is rarely heard in normal adults.

46. a) Sympathetic system

(Ref. Ganong's Physiology 25th edition – pp- 588- Fig. 32.2).

47. b) Increased vagal tone

(Ref. Ganong's Physiology 25th edition – pp- 586).

Explanation- There is a moderate amount of tonic discharge in the cardiac sympathetic nerves at rest, but there is considerable tonic vagal discharge **(vagal tone)** in humans and other large animals. After the administration of muscarinic receptor antagonists such as atropine, the heart rate in humans increases from 70 beats/min, its normal resting value, to 150–180 beats/min because the sympathetic tone is unopposed. In humans in whom both noradrenergic and cholinergic systems are blocked, the heart rate is approximately 100 beats/min.

48. d) Standing from lying position

(Ref. Ganong's Physiology 25th edition – pp- 544- table 30.3).

49. c) Coronary circulation

(Ref. Ganong's Physiology 25th edition – pp- 549- clinical box- 30.3).

50. c) VR = MSFP – RAP RVR

(Ref. Guyton's Physiology 13th edition – pp- 250).

Explanation- Venous return can be calculated by the following formula: VR= Psf – PRA/ RVR= in which VR is venous return, Psf is mean systemic filling pressure, PRA is right atrial pressure, and RVR is resistance to venous return. In the healthy human adult, the values for these are as follows: venous return equals 5 L/min, Psf equals 7 mm Hg, right atrial pressure

equals 0 mm Hg, and resistance to venous return equals 1.4 mm Hg per L/ min of blood flow.

51. a) Cerebral hypoxia

(Ref. Ganong's Physiology 25th edition – pp- 589 – Table32.2).

Explanation- Hypoxia strongly and directly stimulates vasomotor center-producing rise in BP.

52. b) Stroke volume/end-diastolic volume

(Ref. Ganong's Physiology 24th edition – pp- 508).

Explanation- Ejection fraction is about 65%.

53. a) IX nerve

(Ref. Ganong's Physiology 25th edition – pp- 587).

Explanation- The afferent nerve fibers from the carotid sinus form a distinct branch of the glossopharyngeal nerve, the carotid sinus nerve. The fibers from the aortic arch form a branch of the vagus nerve, the aortic depressor nerve.

54. c) Decreased sympathetic discharge to heart

(Ref. Guyton Physiology 12th edition – pp-210).

Explanation- pressure on carotid sinus activates baroreceptors which reflexly decreases HR by inhibiting vasomotor center and stimulating vagal center.

55. b) Endocardium to epicardium

(Ref. Goldbergers Clinical Electro-cardiography 8th edition. page 5).

Explanation- Depolarization and repolarization both start from endocardium, in isolated cardiac muscle. The reason for this is still unknown.

56. b) V/Q ratio

(Ref. Ganong's Physiology 24th edition – pp- 513).

Explanation- Two methods for measuring output that are applicable to humans, in addition to Doppler combined with echocardiography, are the direct Fick method and the indicator dilution method.

57. a) Capillary

(Ref. Ganong's Physiology 25th edition – pp- 568- Table 31.9).

58. e) Inhibition of respiration

(Ref. Ganong's Physiology 25th edition – pp-663).

Explanation- The hyperventilation in shock is due to chemoreceptor stimulation caused by acidosis and hypoxia secondary to local stagnation of blood flow, and is not baroreceptor-mediated.

59. b) End diastolic volume

(Ref. Ganong's Physiology 24th edition – pp-508).

60. d) Pulse pressure

(Ref. Ganong's Physiology 24th edition – pp-567).

Explanation- Baroreceptors respond much more to a rapidly changing pressure than to a stationary pressure.

61. a) Increase in HR & BP

(Ref. Guyton's Physiology 12th edition – pp-210).

Explanation- Occluding the two common carotid arteries, reduces the carotid sinus pressure, as a result, the baroreceptors become inactive and lose their inhibitory effect on the vasomotor center. The vasomotor center then becomes much more than usual, causing the aortic arterial pressure to rise and remain elevated.

62 c. Decreased stimulation of Baroreceptors

Ref. Guyton's Physiology 12th edition – pp-210).

Explanation- Decreased stimulation of baroreceptors reduces the carotid sinus

pressure, as a result, the baroreceptors become inactive and lose their inhibitory effect on the vasomotor center. The vasomotor center then becomes much more than usual, causing the aortic arterial pressure to rise and remain elevated.

63. d) 16 ml/min

(Ref. Ganong's Physiology 25th edition – pp-491).

Explanation- Since Q (blood flow) is directly proportional to 4th power of radius – doubling the radius means that blood flow will increase by 16 times ie. becomes 16mL/min.

64. c) Na^+ entry towards the end of repolarization

(Ref. Ganong's Physiology 24th edition – pp-571).

Explanation- Pacemaker potential is due to slow Na+>> Rapid Ca2+>> decrease K+ permeability. So, with the provided options best answer is c.

65. d) Decreased cutaneous blood flow

(Ref. Ganong's Physiology 25th edition – pp- 614).

Explanation- Shock is more profound in patients with elevated temperatures because of cutaneous vasodilation, and patients in shock should not be warmed to the point that their body temperature rises.

66. c) Purkinje fibres

(Ref. Ganong's Physiology 25th edition – pp- 520).

Explanation- Purkinje fibers, specialized conducting cells, are large with fewer mitochondria and striations and distinctly different from a myocyte specialized for contraction.

67. a) Mean circulatory filling pressure

(Ref. Guyton's Physiology 13th edition – pp- 249).

Explanation- When heart pumping is stopped by shocking the heart with electricity to cause ventricular fibrillation or stopped in any other way, flow of blood everywhere in the circulation ceases a few seconds later. Without blood flow the pressures everywhere in the circulation become equal. This equilibrated pressure level is called the *mean circulatory filling pressure.*

68. d) Venous embolism

(Ref. Ganong's Physiology 25th edition – pp- 566).

Explanation- Thromboses are a major medical problem. They are particularly prone to occur where blood flow is sluggish because the slow flow permits activated clotting factors to accumulate instead of being washed away.. They frequently occlude the arterial supply to the organs in which they form, and bits of thrombus **(emboli)** sometimes break off and travel in the bloodstream to distant sites, damaging other organs. An example is obstruction of the pulmonary artery or its branches by thrombi from the leg veins **(pulmonary embolism).** Prolonged sitting posture leads to stasis of blood.

69. c) Vagus nerve

(Ref. Ganong's Physiology 25th edition – pp- 520).

Explanation- The SA node develops from structures on the right side of the embryo and the AV node from structures on the left. This is why in the adult the right vagus is distributed mainly to the SA node and the left vagus mainly to the AV node.

70 c. 20 mm Hg

(Ref. Ganong's Physiology 25th edition – pp- 631).

Explanation- Surfactant also helps prevent pulmonary edema. It has been calculated that if it were not present, the unopposed surface tension in the alveoli would produce a 20 mm Hg force; such a force would greatly favor transudation of fluid from the blood into the alveoli.

71. c) More than 8 meq/L

(Ref. Ganong's Physiology 25th edition – pp- 631).

Explanation- Hyperkalemia (plasma K+ ±8.5 mEq/L). There is no evidence of atrial activity; the QRS complex is broad

and slurred and the QRS interval has widened to 0.2 s. The T waves remain tall and slender. Further elevation of the plasma K+ level may result in ventricular tachycardia and ventricular fibrillation.

72. c) Isovolumetric relaxation

(Ref. Ganong's Physiology 25th edition – pp- 539).

73. c) 2 ml/min/100 gm

(Ref. Ganong's Physiology 25th edition – pp- 550).

Explanation- Basal O2 consumption by the myocardium is about 2 mL/ 100 g/ min. This value is considerably higher than that of resting skeletal muscle.

74. c) 60-70 %

(Ref. Berne & Levy Physiology, 6th updated edition- Bruce M Koeppen- pp 291).

Explanation- Venous system contains 67% of total blood volume.

75. c) 7.40

(Ref. Ganong's Physiology 25th edition – pp- 645- Table- 35.3).

76. a) 65 mm of Hg

(Ref. Ganong's Physiology 25th edition – pp- 607).

Explanation- This process, by which the flow to many tissues is maintained at relatively constant levels despite variations in perfusion pressure. In the brain, autoregulation maintains a normal cerebral blood flow at arterial pressures of 65–140 mm Hg.

77. b) Hints at serious heart ailment

(Ref. Ganong's Physiology 25th edition – pp- 529).

Explanation- If an irritable ectopic focus discharges once, the result is a beat that occurs before the expected next normal beat and transiently interrupts the cardiac rhythm (atrial, nodal, or ventricular extrasystole or premature beat). If the focus discharges repetitively at a rate higher than that of the SA node, it produces rapid, regular tachycardia (atrial, ventricular, or nodal paroxysmal tachycardia or atrial flutter)

78. e) All of the above

(Ref. Ganong's Physiology 25th edition – pp- 564).

Explanation- When a small blood vessel is transected or damaged, the injury initiates a series of events (**Figure 31–11**) that lead to the formation of a clot. This seals off the damaged region and prevents further blood loss. The initial event is constriction of the vessel and formation of a temporary **hemostatic plug** of platelets that is triggered when platelets bind to collagen and aggregate. This is followed by conversion of the plug into the definitive clot. The constriction of an injured arteriole or small artery may be so marked that its lumen is obliterated, at least temporarily. The vasoconstriction is due to serotonin and other vasoconstrictors liberated from platelets that adhere to the walls of the damaged vessels.

79. c) 5thintercostals space to left or sternum

(Ref. Guyton's Physiology 13th edition – Fig. 23.2 - pp- 280).

80. d) 18

Explanation- Since Q (blood flow)= Pressure difference / Resistance , that means – Resistance = Pressure difference / Blood flow, so , the answer is (90-0) mmHg / 5L/min = 18 W.

81. d) Isovolumetric contraction

(Ref. Ganong's Physiology 25th edition – pp- 564).

82. d) Serotonin

(Ref. Ganong's Physiology 25th edition – Table 32.1- pp- 586).

83 d) Joint proprioceptors

(Ref. Ganong's Physiology 25th edition – pp- 666).

84. a) Brain

(Ref. Ganong's Physiology 25th edition – pp-602).

Explanation- In the choroid plexuses, there are gaps between the endothelial cells of the capillary wall, but the choroid epithelial cells that separate

them from the cerebrospinal fluid (CSF) are connected to one another by tight junctions. The capillaries in the brain substance resemble nonfenestrated capillaries in muscle (see Chapter 31), but there are tight junctions between the endothelial cells that limit the passage of substances via the paracellular route.

85. a) Brain

(Ref. Ganong's Physiology 24th edition – pp- 636).

86. c) Decrease capacitance with shunting of blood

(Ref. Ganong's Physiology 25th edition – pp- 549).

Explanation- Venous return is increased by the activity of the muscle and thoracic pumps; by mobilization of blood from the viscera; by increased pressure transmitted through the dilated arterioles to the veins; and by noradrenergically mediated venoconstriction, which decreases the volume of blood in the veins. Blood mobilized from the splanchnic area and other reservoirs may increase the amount of blood in the arterial portion of the circulation by as much as 30% during strenuous exercise.

87. d) Peripheral vascular resistance

(Ref. Ganong's Physiology 25th edition – pp- 549).

Explanation- The response to exercise involving isotonic muscle contraction is similar in that there is a prompt increase in heart rate, but different in that a marked increase in stroke volume occurs. In addition, there is a net fall in total peripheral resistance due to vasodilation in exercising muscles.

88. a) Local metabolites

(Ref. Guyton's Physiology 12th edition – pp- 1063).

Most important is vasodilatation due to, local metabolites.

89. c) Decrease in HR & BP

(Ref. Guyton's Physiology 12th edition – pp- 210).

Explanation- Occluding the two common carotid arteries, reduces the sinus pressure, as a result, the baroreceptors become inactive and lose their inhibitory effect on the vasomotor center. The vasomotor center becomes much more active than usual, causing the aortic arterial pressure to rise and remain elevated.

90. a) Hyperventilation,

b) Hyperkalemia,

d) ↓ed Pa CO_2

(Ref. Ganong's Physiology 24th edition – pp- 636).

91. b) Reflex bradycardia

(Ref. Guyton's Physiology 12th edition – pp- 210).

Explanation- Pressure on carotid sinus activates baroreceptors. Active baroreceptors reflexly decreases HR by inhibiting vasomotor center and stimulating cardiac vagal center.

92. d) Cardiac output x peripheral resistance

(Ref. Ganong's Physiology 24th edition – pp- 115).

93. c) Glycogen and creatine kinase used anerobically

(Ref. Guyton's Physiology 12th edition – pp- 1063).

Explanation- Muscles contracting under low oxygen conditions produces lactate at the expense of glycogen.

94. a) End diastolic volume of ventricles

(Ref. Ganong's Physiology 24th edition – pp- 515 & 518).

95. c) Mitral stenosis

(Ref. The Cleveland Clinic Cardiology Board by BP Griffin, SR Kapadia , CM Rimmerman).

MR- Right and down.

MS- Left and narrow.

AR- Right and tall.

AS- Upward and left.

96. a) Sum of kinetic energy of flow and pressure energy is constant

(Ref. Ganong's Physiology 24th edition – pp- 545).

Explanation- In a tube or blood vessel the total energy- the sum of kinetic energy of flow and the potential energy is constant.

97. a) Critical velocity

(Ref. Ganong's Physiology 24th edition – pp- 540).

Explanation- Laminar flow occurs at velocities up to a certain critical velocity. At or above this velocity flow is turbulent.

98. a) 0.1 sec

(Ref. Guyton's Physiology 13th edition – pp- 176).

Explanation- AV nodal delay is more than 0.1 s (Guyton), 100ms (Ganong), 60-125 ms (Harrison's Internal Medicine).

99. b) Decrease in K+ permeability

(Ref. Ganong's Physiology 24th edition – pp- 491).

Explanation- Pacemaker potential is due to slow Na+>> Rapid Ca2+ >> decrease K+ permeability.

100. a) Vincent recorded the increasing MBP but kamlesh recorded a decrease in MBP

Explanation- Vincent- At 85 mmHg: during this time baroreceptors are still active (to a lesser degree) so still inhibit vasomotor center, so after cutting the sinus nerve, all inhibitory effect on VMC will be lost, BP will rise.

Kamlesh- At 60 mmHg, baroreceptors are completely inactive but chemoreceptors are still active, chemoreceptors raise the BP by stimulating VMC but after cutting sinus nerve – all stimulatory effect will be lost, so BP will fall.

101. c) Plateau phase of the action potential

(Ref. Ganong's Physiology 24th edition – pp- 490).

102. a) 25 mmHg

(Ref. Harrison' Principles of Internal Medicine 19th edition- Table – 272.2).

Explanation- Right ventricular peak systolic pressure- 17-32 mmHg and End diastolic pressure- 1-7 mmHg.

103. d) Decreased capillary colloid osmotic pressure

Explanation- malnutrition means decreased proteins so decreased oncotic pressure which causes transudation of fluid thus causing bloating.

104. d) Change in posture- lying to standing

(Ref. Ganong's Physiology 24th edition – pp- 555).

Explanation- Lying to standing change in posture decreases venous return to heart due to increase venous pooling in lower part of the body.

105. a) Erythropoietin

106. d) The cerebral arterial pressure rises

(Ref. Ganong's Physiology 25th edition – pp- 607).

Explanation- Conversely, during acceleration downward, force acting toward the head (negative g) increases arterial pressure at head level,

107. b) Sympathetic activity

Explanation- arteriolar diameter decrease will occur due to vasoconstriction, increase renin and vasopressin secretion occurs causing increased water and sodium retention. Bit sympathetic activity will increase causing vasoconstriction.

108. a) Flow = $\frac{(P_A - P_B)\,\pi r^4}{8\eta L}$

(Ref. Ganong's Physiology 24th edition – pp- 541).

109. d) T= wP/r

(Ref. Ganong's Physiology 24th edition – pp- 542).

Explanation- Tension(T) in the wall of cylinder is equal to product of transmural pressure(P) and radius(r) divided by the wall thickness(w) ie. T= PXr/2w

In a sphere P= 2T/r

In a cylinder like blood vessel where one radius is infinite , P= T/r

110. c) Opening of slow Ca^{++} channels

(Ref. Ganong's Physiology 24th edition – pp- 490).

Explanation- plateau phase is due to opening of long lasting Ca2+ channels also known as sow Ca2+ channels.

111. c) Ventricular filling

(Ref. Ganong's Physiology 24th edition – pp- 512).

Explanation- A fourth sound can sometimes be heard immediately before the first heart sound when atrial pressure is high or ventricle is stiff in conditions such as ventricular hypertrophy.

It is due to ventricular filling and is rarely heard in normal adults.

112. a) Directly pyoportional to mean arterial pressure

(Ref. Medical Physiology A Systems Approach by Raff).

Explanation- O2 consumption increases with increase external work done but relationship is not constant.

113. c) Immediate increase in venous return

Explanation- with change in posture from standing to supine – there occurs immediate increase in venous return which increases perfusion to apex– increase in CVP will cause more stimulation of baroreceptors so heart rate will decrease – cerebral blood flow is autoregulated and does not change.

114. d) During exercise systole is shortened more than diastole

(Ref. Ganong's Physiology 24th edition – pp- 512 & 566).

Explanation- during exercise diastole decreases more than systole.

115. a) Does not change

(Ref. Ganong's Physiology 24th edition – pp- 636).

Explanation- The absolute amount of cerebral blood flow remains constant, which means that the % of CO to brain decreases.

116. c) Arterial pressure

(Ref. Berne & Levy Physiology, 6th updated edition- Bruce M Koeppen pp 395).

Explanation- Arterial pressure has least influence on venous return. All other factors in the options are important regulator of venous return.

117. a) Blood pressure

(Ref. Ganong's Physiology 24th edition – pp- 573).

Explanation- Because of strong autoregulation, BP within a limit can't change cerebral blood flow.

118. b) Rate of CSF absorption

(Ref. Ganong's Physiology 24th edition – pp- 603).

Explanation- Lumbar CSF pressure is normally 70–180 mm H2O. Up to pressures well above this range, the rate of CSF formation is independent of intraventricular pressure. However, absorption is proportional to the pressure.

119. a) Specific gravity is 1.003-1.0008

c) Total volume of CSF is 150 ml

d) Daily production is 550ml/day

(Ref. Ganong's Physiology 24th edition – pp- 603).,

120. a) Elastic recoil of aorta

(Ref. Berne & Levy Physiology, 6th updated edition- Bruce M Koeppen pp 337).

Explanation- There is stretching of aorta and arteries during systole due to ejection of blood from ventricle. During ventricular diastole previously stretched and aorta and arteries recoil. The volume of blood that is displaced by the recoil furnishes continuous capillary flow throughout diastole.

121. b) Have role in thermoregulation

(Ref. Ganong's Physiology 24th edition – pp- 538).

Explanation- In the fingers, palms and ear lobes, short channels connect arterioles to venules, by passing the capillaries. These arteriovenous anastomoses , or shuts have thick muscular walls and are abundantly innervated presumably by vasoconstrictor nerves.

122. c) Shortening of phase two

(Ref. Ganong's Physiology 25th edition – pp- 521).

Explanation- Conversely, stimulation of the sympathetic cardiac nerves speeds the depolarizing effect of Ih, and the rate of spontaneous discharge increases (Figure 29–3). Norepinephrine secreted by the sympathetic endings binds to β1 receptors, and the resulting increase in intracellular cAMP facilitates the opening of L channels, increasing ICa and the rapidity of the depolarization phase of the impulse.

123. c) Ejection fraction times cardiac output

Explanation- EF= SV/EDV X CO= SV/EDV X SV X HR, which is not EDV.

124. a) Increase in the number of open capillaries

(Ref. Medical Physiology A Systems Approach by Raff page 344).

Explanation- During exercise, high CO flows through pulmonary vessels. But due to recruitment of more capillaries and dilatation of pulmonary capillary (high compliance), resistance does not change significantly.

125. d) All of above

(Ref. Ganong's Physiology 24th edition – pp- 561).

Explanation- Low pressure baro-receptors are located within the wall of both right and left atrium and pulmonary artery.

126. c) Gastrointestinal smooth muscle relaxation

(Ref. Ganong's Physiology 24th edition – pp- 472, GIT chapter).

127. c) Increased refractory period

(Ref. Ganong's Physiology 24th edition – pp- 556).

Explanation-Sympathetic causes faster conduction (decreased refractory period).

128. b) Stimulated by atrial systole and diastole

(Ref. Ganong's Physiology 24th edition – pp- 560).

Explanation- Volume receptors are low pressure receptors located within the atrium. The stretch receptors in atria are of 2 types- those that discharge primarily during atrial systole(Type A) and those that discharge primarily late in diastole at the time of peak atrial filling (Type B). Cardiac output will affect high pressure baroreceptor (carotid sinus & aortic arch)not the volume receptor.

129. a) Increased VR - increased CO)

(Ref. Ganong's Physiology 24th edition – pp- 515).

Explanation-Energy or force of contraction is proportional to the initial length of cardiac muscle fiber. For the heart , the length of the muscle fiber is proportional to the end diastolic volume.

130. c) Relaxation of LV with mitral & aortic valve closed

(Ref. Ganong's Physiology 24th edition – pp- 509).

Explanation- After the valves are closed, pressure continues to drop rapidly during the period of isovolumetric ventricular relaxation.

131. a) Large elastic vessels

(Ref. Berne & Levy Physiology, 6th updated edition- Bruce M Koeppen- pp 336).

132. b) Decreased K^+efflux, decreased slopeof phase 4

(Ref. Ganong's Physiology 24th edition – pp- 491).

133. b) AV node

(Ref. Flip and See ECG By Elizabeth Gross Cohn 4th edition).

Explanation- AV node is located on the floor of the right atrium. It has an intrinsic firing rate of 40-60 beats per minute. It is known as gate keeper of the heart, because it regulates impulses coming from the SA nose.

134. b) Veins

(Ref. Ganong's Physiology 24th edition – pp- 543).

Explanation- A large amount of blood can be added to the venous system before the veins become distended to the point where further increments in volume produce a large rise in venous pressure. The veins are therefore called capacitance vessels.

135. d) 65%

(Ref. Ganong's Physiology 24th edition – pp- 538).

Explanation- Ejection fraction, the percentage of the end-diastolic ventricular volume that is ejected with each stroke, is about 65%. The ejection fraction is a valuable index of ventricular function.

136. a) 55 ml/100 gm/min

(Ref. Ganong's Physiology 25th edition –Table 33.2- pp-602).

137. d) Endothelin

(Ref. Ganong's Physiology 25th edition -pp-595).

Explanation- Endothelial cells also produce endothelin-1, one of the most potent vasoconstrictor agents yet isolated. Endothelin-1 (ET-1), endothelin-2 (ET-2), and endothelin-3 (ET-3) are the members of a family of three similar 21-amino-acid polypeptides

138. b) Isovolumetric contraction

(Ref. Ganong's Physiology 24th edition –pp-508).

139. b) Pregnancy

(Ref. Ganong's Physiology 25th edition –Table 30.3- pp-544).

140. a) 0.12- 0.2 sec

(Ref. Ganong's Physiology 25th edition –Table 29.2- pp-524).

141. b) Fast sodium channels opening

(Ref. Ganong's Physiology 24th edition - pp-491).

Explanation- Pacemaker potential is due to slow Na+ >> Fast Ca2+>> decrease K+ permeability.

142. a) Baroreceptor

(Ref. Guyton's Physiology 13th edition – pp- 194).

Explanation- most physiologists believe that the interstitial fluid pressure in loose subcutaneous tissue is, in normal conditions, slightly less subatmospheric, averaging about −3 mm Hg.

143. b) Decreased blood volume

144. a) Less gap junction

(Ref. Guyton's Physiology 13th edition – Fig. 24.1 – pp 289).

145. b) Heart

(Ref. Guyton's Physiology 13th edition – Fig. 24.1 – pp 291).

146. a) 5-10 mm Hg

(Ref. Guyton's Physiology 13th edition -pp 1070).

147. d) 60% diastolic + 40% systolic

(Ref. Ganong's Physiology 24th edition - pp-544).

148. c) Hypocalcemic tetany

(Ref. Ganong's Physiology 25th edition - pp-380).

Explanation- Trousseau sign, a spasm of the muscles of the upper extremity that causes flexion of the wrist and thumb with extension of the fingers. In individuals with mild tetany in whom spasm is not yet evident, Trousseau sign can sometimes be produced by occluding the circulation for a few minutes with a blood pressure cuff.

149. a) Heart rate

(Ref. Ganong's Physiology 25th edition - pp-586).

Explanation- There is a moderate amount of tonic discharge in the cardiac sympathetic nerves at rest, but there is considerable tonic vagal discharge (vagal tone) in humans and other large animals. After the administration of muscarinic receptor antagonists such as atropine, the heart rate in humans increases from 70 beats/min, its normal resting value, to 150–180 beats/min because the sympathetic tone is unopposed.

150. c) There Is greater decrease in ventricular diastole than ventricular systole

(Ref. Ganong's Physiology 24th edition - pp-512 & 556).

151. b) Pulmonary vein

152. b) NO

153. b) Diastole

(Ref. Ganong's Physiology 25th edition - pp-611).

154. c) Increased automaticity

Explanation- c is the effect of sympathetic stimulation.

155. c) Capillaries

Explanation- velocity of blood flow is inversely proportional to cross sectional area, since capillaries have highest CSA so slowest velocity.

156. d) Pulmonary capillary wedge pressure

157. d) High BP & low heart rate

(Ref. Ganong's Physiology 25th edition – pp- 593).

Explanation- The resultant rise in systemic arterial pressure (Cushing reflex) tends to restore the blood flow to the medulla. Over a considerable range, the blood pressure rise is proportional to the increase in intracranial pressure. The rise in blood pressure causes a reflex decrease in heart rate via the arterial baroreceptors.

158. c) Pascal

(Ref. Ganong's Physiology 24th edition - pp-544)

Explanation- SI unit of BP is kPa , where 1mmHg= 0.133kPa.

159. b) Cushing disease

(Ref. Ganong's Physiology 25th edition – pp- 593).

160. a) Atrial contraction

(Ref. Guyton's Physiology 13th edition -Fig. 9.7- pp 114).

Explanation- The a wave is caused by atrial contraction. Ordinarily, the right atrial pressure increases 4 to 6 mm Hg during atrial contraction, and the left atrial pressure increases about 7 to 8 mm Hg.

161. d) 300-400%

Ref. Guyton's Physiology 13th edition – pp- 277).

Explanation- The maximum percentage that cardiac output can increase above normal is called cardiac reserve. It is 300-400% in healthy young adult , 500 to 600% in athletic and 200-250% in old age.

162. c) Acts along with the cardiovagal centre (CVC) to maintain blood pressure

d- (Ref: Ganong's Physiology, 25th edition, page 589).

Explanation- VMC & CIC re the centers for both baroreceptor and chemoreceptor. Both are influenced by cortico- hypothalamic inputs.

Q13. True regarding pulmonary ventilation is:

a. Ventilation per unit volume is max at base
b. Ventilation per unit volume is max at apex
c. Perfusion is less at base
d. V/Q ratio is low at apex

Q14. Which of the following conditions is likely to cause a shift of the oxygen-haemoglobin dissociation curve to the right?

a. Hypothermia
b. Exercise
c. Carbon monoxide poisoning
d. Transfusion with banked blood

Q15. All except which of the following is true about airway resistance

a. Airway resistance is lower at high lung volumes
b. Patients with increased airway resistance frequently have high lung volumes
c. Airway resistance is not affected by the density and viscosity of the inspired gas
d. Patients in status asthmaticus are sometimes treated with a mixture helium and oxygen

Q16. Inflation of lungs induces further inflation- this is explained by

a. Hering-breuer inflation reflex
b. Hering-breuer deflation reflex
c. Head's paradoxical reflex
d. J-receptor reflex

Q17. Partial pressure of O_2 at atmosphere pressure of 760 mm of Hg-

a. 76 mm of Hg
b. 160 mm of Hg
c. 120 mm of Hg
d. 140 mm of Hg

Q18. Acclimatization does not include :

a. Hyperventilation
b. Decreased concentration of 2,3 DPG in RBC
c. Increased erythropoiesis
d. Kidney excrete more alkali

Q19. Joint pain in a deep sea diver is due to:

a. Increased O_2 b. Increased CO_2
c. Increased N_2O d. Increased N_2

Q20. Barometric pressure at 100 meter below sea level is :

a. 3 atm b. 4 atm
c. 10 atm d. 11 atm

Q21. Carotid body is not stimulated by :

a. Hypoxic hypoxia
b. Anaemic hypoxia
c. Stagnant hypoxia
d. Histotoxic hypoxia

Q22. Severe hypoxia may produce :

a. Bp rise
b. Bp fall
c. Fall followed by Bp rise
d. No change

Q23. Arterial O_2 content is reduced in one of the following :

a. Stagnant hypoxia
b. Anemic hypoxia
c. Histotoxichypoxia
d. Ischemic hypoxia

Q24. If an unacclatimised person is suddenly exposed to cold atmosphere change seen are :

a. Increase in systolic BP
b. shift of blood from shell to core
c. Non thermogenic shivering
d. Tachycardia

Q25. Which one of the following is a potent stimulus for the production of erythropoietin :

a. Alpha interferon
b. Interleukin -3
c. Hypoxia
d. Hypercarbia

Q26. The oxygen – hemoglobin dissociation curve is sigmoid because-

a. Binding of one oxygen molecule increases the affinity of binding other O_2 molecules
b. Binding of one oxygen molecules decrease the affinity of binding other O_2 MOLECULES
c. Oxygen affinity of Hemoglobin decreases when the pH of blood falls
d. Binding of oxygen to hemoglobin reduces the affinity of Hb for CO_{2ns-}

13. a	14. b	15. c	16. c	17. b	18. b	19. d	20. d	21. b	22. a
23. b	24. b	25. c	26. a						

Q27. Central chemoreceptors are most sensitive to following changes in blood-

a. ↑ PCO_2
b. ↓PCO_2
c. ↑ H+
d. ↓ PO2

Q28. Cyanosis does not occur in severe anemia because-

a. Hypoxia stimulates erythropoietin production
b. Oxygen carrying capacity of available Hb is increased
c. Critical concentration of Hb required to produce cyanosis is reduced
d. Oxygen Hemoglobin curve shift to the right

Q29. Fetal hemoglobin has higher affinity for oxygen due to-

a. Decreased affinity for 2,3 DPG
b. Reduced pH
c. Increased release of carbon dioxide
d. Oxygen dissocation curve is shifted to right

Q30. All of the following statements about bronchial circulation are true, except-

a. Contribute 2% of systemic circulation
b. Contribute to gaseous exchange
c. Cause venous admixing of blood
d. Provide nutritive function to lung

Q31. In a person acclimatized for high altitude, O_2 saturation is maintained because of :

a. Increase Hb concentration
b. Increase RBC count
c. Better duffusion in lungs
d. All of the above

Q32. Hypoxia due to slowing of circulation is seen in which of the following :

a. Anemic anemia
b. Histotoxic
c. Heart disease
d. Stagnant

Q33. Maximum oxygen is transported in blood :

a. In dissolved form
b. By albumin
c. By hemoglobin
d. By WBC

Q34. Unloading of oxygen to tissues cell by oxy-hb is assisted by :

a. Bohr - Affect
b. 2-3 diphosphoglycerate
c. Low PO_2 and high PCO_2 in tissues
d. All of the above

Q35. Haldane effect is :

a. Binding of O_2 to Hb favors exhalation of CO_2
b. Binding of CO_2 to Hb favors release of O_2
c. Imortant mechanism of O_2 transport in body
d. All of above

Q36. The cause of death in cyanide poisoning is :

a. Anoxic anoxia
b. Anaemic anoxia
c. Histotoxic anoxia
d. Stagnant anoxia

Q37. Which of the following does not occur as the blood passes through systemic capillaries:

a. Increased protein content
b. Shift of hemoglobin dissociation curve to left
c. Increased hematocrit
d. decreased pH

Q38. Vagal stimulation causes the following effects except-

a. Increase in intestinal secretion
b. Constriction of intestinal musculature
c. Relaxation of bronchial musculature
d. Fall in the blood pressure.

Q39. Bilateral section of the vagus nerve results in-

a. Increased rate of respiration
b. Decreased depth of respiration
c. Irregular breathing patterns
d. Increases in breath-holding time

Q40. Transection at mid pons level with bilateral vagotomy results in-

a. Asphyxia
b. Hyperventilation
c. Rapid and shallow breathing
d. Apneusis

27. c	28. c	29. a	30. b	31. d	32. d	33. c	34. d	35. a	36. c
37. b	38. c	39. d	40. d						

Respiratory Physiology – Questions

Q1. Nitrogen narcosis is caused due to-

a. Nitrogen inhibits dismutase enzyme
b. Increase production of nitrous oxide
c. Increased solubility of nitrogen in nerve cell membrane
d. Decrease in oxygen free radicals

Q2. The intrapleural pressure is negative both during inspiration and expiration because

a. Intrapulmonary pressure is always negative
b. Thoracic cage and lungs are elastic structures
c. Transpulmonary pressure determines the negativity
d. Surfactant prevents the lung to collapse

Q3. The pleural pressure of a normal 56 year old woman is approximately -5 cm of water during resting conditions before inspiration (i.e. at functional residual capacity). What is the pleural pressure during inspiration?

a. +1cm of water b. +4cm of water
c. -3cm of water d. -7 cm of water

Q4. Pleural pressure is positive in

a. end of inspiration
b. End of expiration
c. end of forced expiration
d. Start or beginning of inspiration

Q5. Transpulmonary pressure at the start of inspiration is

a. 0 mms of Hg b. 2 mms of Hg
c. -6 mms of Hg d. +6 mms of Hg

Q6. One of the following causes bronchodilation.

a. Substance P b. Ach
c. VIP d. Leukotrienes

Q7. In rapid, shallow breathing which of the following is true?

a. alveolar ventilation is less than in slow, deep breathing
b. alveolar ventilation is more than in slow, deep breathing
c. alveolar ventilation in both is equal
d. Data insufficient

Q8. Tidal volume is (AI 2001)

a. Total vital capacity + RV
b. Functional residual capacity – RV
c. TLC – RV
d. Inspiratory capacity – inspiratory reserve volume

Q9. Total lung capacity depends on (AI 98)

a. size of airway b. closing volume
c. lung compliance d. residual volume

Q10. Regarding pulmonary function tests all are true except

a. total lung volume increases in emphysema
b. compliance decreases in interstitial lung disease
c. compliance is total lung distensibility
d. FEV1 is forced expiratory volume at one minute

Q11. Which of the following is used to measure the resistance in small airways

a. Vital capacity
b. FEV1
c. Mid expiratory flow rate
d. Closing volume

Q12. The intrapleural pressure gradient from the base to the apex of the lungs is:-

a. 0 cms of H_2O
b. 2 cms of H_2O
c. 7.5 cms of H_2O
d. 10 cms of H_2O

1. c	2. b	3. d	4. c	5. b	6. c	7. a	8. d	9. c	10. d
11. c	12. c								

compression, which is a very sensitive marker of small airway limitations.

12. c) 7.5 cms of H_2O

(Ref. Ganong's Physiology 2th edition, Fig. 34.16- page 636).

Explanation- at the start of inspiration intrapleural pressure is less negative at the base -2.5 mmHg) than at the apex (-10mmHg). So, intrapleural pressure gradient from base to apex becomes - -2.5- (-10)= + 7.5 mmHg.

13. a) Ventilation per unit volume is max at base

(Ref. Ganong's Physiology 24th edition, pp 603).

Explanation- Ventilation is maximum at base of lungs. Perfusion is maximum at base of lungs. V/Q ratio is maximum at apex of lungs. PO2 is maximum at apex and PCO2 is maximum at base.

14. b) Exercise

15. c) Airway resistance is not affected by the density and viscosity of the inspired gas

(Ref. Ganong's Physiology 24th edition, pp 540).

Explanation- Probability of turbulent blood flow through an orifice depends on Reynolds no.- Re= ρDV/ ή where ρ is density , D is diameter, V is velocity and ή is viscosity.

16. c) Head's paradoxical reflex

(Ref. Understanding Medical Physiology: A Textbook for Medical Students by RL Bijlani, S Manjunatha, 4th edition, Chapter 4.5).

Explanation- since, inflation of lung induces further inflation, the reflex is known as paradoxical.

17. b) 160 mm of Hg

(Ref. Guyton's Physiology 13th edition, pp 519).

Explanation- At sea level with an atmospheric pressure of 760 mmHg, percentage of O2 is appx. 21% so, partial pressure of O2 is= .21 x 760= 159.6 mmHg.

18. b) Decreased concentration of 2,3 DPG in RBC

(Ref. Ganong's Physiology 24th edition, pp 619).

Explanation- Erythropoietin secretion increases promptly on ascent to high altitude. The increase in circulating RBCs triggered by the erythropoietin begins in 2-3 days and is sustained as long as the individual remains at high altitude.

19. d) Increased N_2

(Ref. Guyton's Physiology 13th edition, pp 548).

Explanation- In most people with decompression sickness, the pain in joints occur in 85% - 90% . This pain is due to N2 bubbles blocking blood in many tissues.

20. d) 11 atm

(Ref. Guyton's Physiology 13th edition, Fig. 45.1, pp 570).

Explanation- for each 10 m depth below the sea level, atmospheric pressure rises by 10 atm. So, pressure at 100m is – 1 atm at sea level + 10 atm(for 100m) = 11 atm.

21. b) Anaemic hypoxia

(Ref. Ganong's Physiology 25th edition, pp 659).

Explanation- Blood flow in each 2 mg carotid body is 2L/100gm of tissue/min. Because of this enormous blood flow O2 needs of the glomus cells can be met largely by dissolved O2 alone. Therefore, receptors are not stimulated in conditions such as anemia or carbon monoxide poisoning , in which the amount of dissolved O2 is normal, even though the combined O2 in blood is markedly decreased.

22. a) Bp rise

(Ref. Ganong's Physiology 25th edition, pp 593).

Explanation- Under these conditions, hypoxia stimulates the chemoreceptors. The stimulation raises the blood pressure, which improves the blood flow in the receptor organs and eliminates

the stimulus to the chemoreceptors, so that the pressure falls and a new cycle is initiated.

23. b) Anemic hypoxia

(Ref. Ganong's Physiology 24th edition, pp 621, Figure).

Explanation- Oxygen content is reduced because of less Hb content in blood.

24. b) shift of blood from shell to core

Explanation- Vasoconstriction is first physiological mechanism activated in cold weather.

25. c) Hypoxia

(Ref. Ganong's Physiology 24th edition, pp 672).

Explanation- The usual stimulus for erythropoietin secretion is hypoxia, but secretion of the hormone can also be stimulated by androgens and cobalt salts.

26. a) Binding of one oxygen molecule increases the affinity of binding other O_2 molecules

(Ref. Ganong's Physiology 24th edition, pp 611).

Explanation- Hemoglobin shows positive cooperative binding.

27. c) ↑ H+

(Ref. Medical Physiology by WF Boron and EL Boulpaep 2nd edition, Chapter 32).

Explanation- Both central and peripheral chemoreceptors are sensitive to PaCO2. But primary stimulus for peripheral chemoreceptor is hypoxia and central chemoreceptor is H+ ion.

28. c) Critical concentration of Hb required to produce cyanosis is reduced

(Ref. Clinical Methods: The History, Physical and Laboratory Examinations, 3rd edition, HK Walker).

Explanation- In anemic persons when Hb level is very low, much more profound decrease in tissue oxygen levels are required to produce 5gm/dL of deoxyhemoglobin in capillary blood, which is generally not possible.

29. a) Decreased affinity for 2,3 DPG

(Ref. Ganong's Physiology 24th edition, pp 611).

Explanation- 2,3 DPG is very plentiful in red cells. It is a highly charged anion that binds to β chains of deoxyhemoglobin. Fetal Hb does not bind 2,3 DPG because of its gamma chains.

30. b) Contribute to gaseous exchange

(Ref. Ganong's Physiology 24th edition, pp 592).

Explanation- Pulmonary circulation is responsible for gaseous exchange and not bronchial circulation.

31. d) All of the above

(Ref. Ganong's Physiology 25th edition, pp 648).

32. d) Stagnant

(Ref. Ganong's Physiology 25th edition, pp 651).

Explanation- Ischemic hypoxia, or stagnant hypoxia, is due to slow circulation and is a problem in organs such as the kidneys and heart during shock.

33. c) By hemoglobin

(Ref. Ganong's Physiology 24th edition, pp 610).

Explanation- 99% of arterial O2 is carried by Hb, only 1% is in dissolved form.

34. d) All of the above

(Ref. Ganong's Physiology 25th edition, Fig. 35.2,pp 641).

35. a) Binding of O_2 to Hb favors exhalation of CO_2

(Ref. Ganong's Physiology 25th edition, pp 612).

Explanation- Binding of O2 to Hb reduces its affinity for CO2 occurs in lungs.

36. c) Histotoxic anoxia

(Ref. Ganong's Physiology 25th edition, pp 651).

Explanation- Hypoxia due to inhibition of tissue oxidative processes is most commonly the result of cyanide poisoning. Cyanide inhibits cytochrome oxidase and possibly other enzymes. Methylene

blue or nitrites are used to treat cyanide poisoning

37. b Shift of hemoglobin dissociation curve to left

(Ref. Ganong's Physiology 24th edition, pp 611).

Explanation- At the level of tissue, high CO2 and low pH shifts the OHD curve to the right, thus releasing more oxygen to the tissues. Because of small amount of fluid filtration into the tissue, protein concentration increases a little.

38. c) Relaxation of bronchial musculature

Explanation- Vagal stimulation causes bronchoconstriction.

39. d) Increases in breath-holding time

(Ref: Ganong's Physiology, 25th edition, page 657).

Explanation- This is why the depth of inspiration is increased after vagotomy (Figure 36–2) and apneusis develops if the vagi are cut after damage to the pneumotaxic center. Vagal feedback activity does not alter the rate of rise of the neural activity in respiratory motor neurons (Figure 36–3).

40. d) Apneusis

(Ref: Ganong's Physiology, 25th edition, page 657).

Explanation- This is why the depth of inspiration is increased after vagotomy and apneusis develops if the vagi are cut after damage to the pneumotaxic center.

Central Nervous System – Questions

1. **Which one of the following statements is true for excitatory postsynaptic potentials (EPSP) –**
   a. Are self propagating
   b. Show all or none response
   c. Are proportional to the amount of transmitter released by the presynaptic neuron
   d. Are inhibitory at presynaptic terminal

2. **The intrafusal fibres of the striated skeletal muscles are innervated by one of the following type of motor neurons, Choose the correct answer:**
   a. Alpha b. Beta
   c. Gamma d. Delta

3. **Weber Fechner Law is –**
   a. Magnitude of stimulus strength perceived is approximately proportionate to the log of the intensity of stimulus strength
   b. Magnitude of stimulus strength perceived is directly proportional to the intensity of stimulus strength
   c. Threshold of receptor is directly proportional to stimulus strength
   d. Threshold of receptor is inversely proportional to stimulus strength

4. **Muscle spindle detects-**
   a. Tension b. Length
   c. Proprioception d. Stretch

5. **The following is an example of a primarily inhibitory amino acid-**
   a. Glutamate b. Aspartate
   c. GABA d. Somatostatin

6. **Major neurotransmitter released at end organ effectors of the sympathetic division of the autonomic nervous system –**
   a. Adrenaline b. Noradrenalin
   c. Dopamine d. Acetylcholine

7. **Synaptic transmission in the autonomic ganglion is usually:**
   a. Adrenergic
   b. Peptidergic
   c. Cholinergic
   d. Mediated by substance P

8. **Motor area in cerebrum is mainly associated with –**
   a. Performing all voluntary movements
   b. Performing an involuntary movements
   c. Executing fine movements
   d. Controlling all motor activity

9 **The Inability of the body's natural defence system to detect an abnoxious odour following long term exposure to the smell is called –**
   a. Olfactory fatigue
   b. Rhinoreaction
   c. Rhinostenosis
   d. Rhinorrhoea

10 **For the convergence of rays on to the retina, most important structure is–**
   a. Anterior surface of cornea
   b. Lens curvative
   c. Size of eye ball
   d. Aequous humour

11 **Blind spot of mariotte is –**
   a. Fovea centralis
   b. Macula lutea
   c. Optic disc
   d. None of the above

12 **Kluver-Bucy syndrome is characterized by all except-**
   a. Korsakoff amnesia
   b. Apathy and placidity
   c. Decreased sexual activity
   d. Sham rage

13 **EEG in paradoxical sleep is –**
   a. Low amplitude mixed frequency
   b. High amplitude low frequency
   c. Q – waves
   d. Delta & Theta waves

1. c	2. c	3. a, c	4. b	5. c	6. b	7. c	8. a	9. a	10. a
11. c	12. c	13. a							

14. **Thalamus relay all sensory sensations except-**
a. Touch b. Temperature
c. Olfaction d. Auditory

15 **Which one of the following regions of the body has the largest representation in cortical area –**
a. Trunk muscle
b. Muscles of forearm
c. Muscles of mastication
d. Muscles of thumb

16 **Lowest representation in sensory cortex is for –**
a. Thumb b. Genitalia
c. Tongue d. Face

17 **Function of the thalamus is –**
a. Relay centre
b. Arousal
c. Pain perception
d. Pain localization

18 **The receptors of pain is –**
a. Ruffini organs
b. Meckel's bodies
c. Golgi bodies
d. Free nerve endings

19 **First relay station of pain is:**
a. Spinal cord b. Medulla
c. Pons d. Thalamus

20 **The neuromuscular transmitter is –**
a. Dopamine
b. Epinephrine
c. Norepinephrine
d. Acetyl choline.

21 **The satiety centre is located in the –**
a. Dorsomedian nucleus of hypothalamus
b. Ventromedian nucleus of hypothalamus
c. Perifornical region
d. Lateral hypothalamic area

22 **Lesions in ..... lead to sensory ataxia-**
a. Posterior column
b. Vermis
c. Floculo-nodular lobe
d. Vestibular apparatus

23 **Crude touch sensations are carried by –**
a. Lateral spinothalamic tract
b. Ventral spinothalamic tract
c. Posterior columns
d. Pyramidal tracts

24. **The basic postural reflex is-**
a. Crossed extensor reflex
b. Golgi tendon reflex
c. Stretch reflex
d. Positive supporting reflex

25. **Transection of medullary pyramid result in**
a. Hypotonia
b. Atrophy of muscles
c. Forced grasping
d. Positive babinski sign

26. **What is the mechanism by which infection causes fever-**
a. Increased heat production and decreased heat loss
b. Decreased heat production and decreased heat loss
c. Pyrogens act on hypothalamus
d. None of the above.

27. **Damage to sensory area 1 of the cerebral cortex results in –**
a. Loss of perception of pain
b. Loss of tactile and two-point discrimination
c. Loss of perception of touch
d. Loss of only tactile discrimination.

28. **Vomiting centre is situated in the –**
a. Hypothalamus b. Amygdala
c. Pons d. Medulla

29. **Pain producing substance is-**
a. Serotonin b. Substance P
c. Histamine d. Acetyl choline

30. **Swallowing centre is situated in –**
a. Midbrain b. Pons
c. Medulla d. Cerebellum

31. **Pyrogens raise body temperature by**
a. Setting the thermostat to higher level
b. Releasing interleukins
c. Decreasing peripheral heat liberating mechanism
d. Causing peripheral vasoconstriction.

14. c	15. c	16. b	17. a	18. d	19. a	20. d	21. b	22. a	23. b
24. c	25. a	26. c	27. b	28. d	29. b	30. c	31. b		

32. **Medial geniculate body is concerned with –**
a. Hearing
b. Vision
c. Smell
d. Taste

33. **Smell receptors are seen in –**
a. Lower 1/3 of nasal mucosa
b. Upper 1/3 of nasal mucosa
c. Amygdaloid body
d. Cribriform plate

34. **Which is caused by Acetylcholine through Nicotinic receptors-**
a. Contraction of Skeletal muscle
b. Decrease of heart rate
c. Secretion of Saliva
d. Contraction of pupils

35. **The intensity of sensory stimuli is determined by –**
a. Duration of latent period
b. Amplitude of action potential
c. Frequency of action potential
d. Amplitude of generation potential

36. **Nucleus gracilis and Nucleus cuneatus are the first synapse for –**
a. Dorsal columns
b. Dorsa lateral tract
c. Ventral spino thalamic tract
d. Lateral spinothalamic tract

37. **Paccinian corpuscles are major receptors for –**
a. Pressure
b. Pain
c. Touch
d. Temperature

38. **Spinothalamic tract transmits all the following sensations except-**
a. Proprioception
b. Pain
c. Temperature
d. Touch

39. **Increased Gamma efferent discharge is seen in all except-**
a. Jendrassik's maneuvre
b. Anxiety
c. Rapid shallow breathing
d. Stimulation of skin

40. **The electroencephalographic (EEG) curves are called–**
a. ABCDE curves
b. Berger's Rhythm
c. Neurogenic Rhythm
d. REM Rhythm

41. **Motor area of Brodman's is area –**
a. 1
b. 4
c. 5
d. 7

42. **Satiety centre in hypothalamus is regulated by –**
a. Gastric dilatation
b. Blood glucose levels
c. Blood insulin levels
d. All of the above

43. **What is true regarding the gamma efferent neuron –**
a. An 'A' group motor neuron with a smaller diameter than that of alpha efferent neurons
b. Innervates intrafusal fibres
c. Innervates muscle fibres that stretch annulospiral endings
d. All of the above.

44. **A unilateral upper motor neuron lesion in the internal capsule is best characterized by –**
a. Diminished use of contralateral appendages below the lesion
b. Muscle fasciculations
c. Ipsilateral hypotonicity
d. Flexion of the leg

45. **Which of the following reflexes disappear in the absence of functional connections between the spinal cord and the brain?**
a. Swallowing reflex
b. Positive supporting reflex
c. Withdrawal reflex
d. Erection of penis
e. All of the above.

46. **Muscle spindle is –**
a. Receptor for a variety of multisynaptic reflexes
b. Receptor for stretch receptor reflex
c. Occurs only in antigravity extensor muscles
d. Excited by both stretch and contraction of the muscles in which it is located

47. **The EEG rhythm having lowest frequency is –**
a. Alpha
b. Beta
c. Delta
d. Theta

32. a	33. a	34. a	35. c	36. a	37. c	38. a	39. c	40. b	41. b
42. d	43. d	44. a	45. a	46. b	47. c				

48. Most of the refraction that occurs in the eye occurs at the –
a. Anterior surface of cornea
b. Posterior surface of cornea
c. Anterior surface of lens
d. Posterior surface of lens

49. An EEG-
a. Provides indication of intelligence
b. Tends to show waves of smaller amplitude during deep sleep than of alert state
c. Show waves with a lower frequency during intense thought than during sleep
d. Is bilaterally symmetrical

50. Most of the incoming sensory information goes to which cortical layer?
a. Layer 2 b. Layer 3
c. Layer 4 d. Layer 5

51. Decerebrate animal results from the following experimental procedure-
a. Removal of the cerebrum
b. Transection at the upper border of midbrain
c. Inter collicular transection
d. Section above the thalamus

52. Which of the following statement is not true-
a. Decorticate rigidity is greater than decerebrate rigidity
b. Righting reflexes are absent in the decrebrate animal
c. Visual righting reflex is present in a thalamic
d. Decorticate rigidity is seen only when the animal is at rest

53. Level of integration of stretch reflex is at –
a. Cerebral cortex
b. Medulla
c. Lower medulla
d. Spinal cord

54. Buerger waves (alpha waves) of EEG have the rhythm per sec of –
a. 0-4 b. 4-7
c. 8-13 d. 13-30

55. The usual voltage of alpha rhythm in (microvolts)-
a. 5 b. 40
c. 50 d. 60

56. Weber fechner law deals with –
a. Frequency discrimination
b. Receptive field organization
c. Intensity discrimination
d. Two point discrimination

57. The frequency of beta waves (per sec) in EEG is –
a. 0-4 b. 4-7
c. 8-13 d. 13-30

58. Which sensation is detected by free nerve endings?
a. Light touch b. Pain
c. Pressure d. Muscle stretch

59. Flocculonodular lobe of cerebellum is concerned with-
a. Equilibrium b. Co-ordination
c. Baroreception d. Chemoreception

60. Vestibular fibres relay in –
a. Vermis
b. Lateral genticulate body
c. Flocculonodular lobe of cerebellum
d. Auditory cortex

61. Destruction of lateral nucleus of hypothalamus lead to –
a. Aphagia b. Hyperphagia
c. Satiety d. Somnolence

62. Warmth sensation is sensed by-
a. Pacinian capsule
b. eissner's capsule
c. Ruffin end organ
d. Krause's end bulb
e. None of the above.

63. Hypothalmus regulates all except-
a. Food intake
b. Temperature
c. Anticipatory rise in heart rate (Medulla)
d. Hypophysis.

64. Alpha-wave in EEG is seen in –
a. Sleep
b. REM sleep
c. Awake with eyes closed
d. Mental work

48. a	49. d	50. c	51. c	52. a	53. d	54. c	55. c	56. c	57. d
58. b	59. a	60. c	61. a	62. e	63. c	64. c			

65. Loss of feel of size & shape of an object is seen in lesion of –
a. Tractus gracilis
b. Tractus cuneatus
c. Lateral spinothalamic tract
d. Cerebral cortex.

66. In hippocampus EEG Waves are –
a. Alpha wave b. Beta-wave
c. Theta-wave d. Delta wave.

67. Blood brain barrier is maximally permeable to –
a. Na^+ b. K^+
c. Chloride d. CO_2

68. Circadian rhythm is controlled by-
a. Supra chiasmatic nucleus
b. Hypothalamus
c. Thalamus
d. Pineal gland

69. Receptor which itself is a dendrite of a nerve-
a. Olfactory b. Gustatory
c. Visual d. Hearing

70. Osmoreceptor is located at which site-
a. Anterior hypothalamus
b. Renal medulla
c. Carotid body
d. Atrial chamber

71. Crossed extensor reflex is a –
a. Withdrawal reflex
b. Postural reflex
c. Monosynaptic reflex
d. Sympathetic.

72. Arousal response is mediated by-
a. Dorsal column
b. Reticular activating system
c. Spinothalamic tract
d. Vestibulo cerebeller tract

73. IPSP is due to –
a. Cl^- influx b. K^+ influx
c. Na^+ influx d. Ca^{++} influx

74. EPSP is due to –
a. K^+ influx b. Na^+ efflux
c. Na^+ influx d. Ca^{++} influx

75. Skilled voluntary movement is initiated at-
a. Cerebral cortex (motor cortex)
b. Basal ganglia
c. Cortical association
d. Cerebellum

76. UMN includes-
a. Pyramidal cells
b. Peripheral nerves
c. Anterior horn cells
d. Glial Cells

77. The only sensory modality which does not reach the thalamus is –
a. Proprioception
b. Taste
c. Olfaction
d. Pain and temperature

78. Gate system for pain control at-
a. Substantia gelatinosa
b. Dorsal root ganglion
c. Both
d. None

79. The primary motor area for shivering is–
a. Cerebrum
b. Red nucleus
c. Ventromedical anterior hypothalamus
d. Dorsomedial posterior hypothalamus

80. The distance by which two touch stimuli must be separated to be perceived as two separate is greatest at-
a. The lips
b. The palm of the hand
c. The back of scapula
d. The dorsum of the hand

81. Thirst is activated by-
a. Increased Angitension II level
b. Extracellular hypersmolarity
c. Increased ANP levels
d. Increased Renin levels

82. Neurotransmitter involved in nigrostriatial pathway is –
a. Serotonin b. Dopamine
c. Cholinergic d. Adrenergic

65. b	66. c	67. d	68. a	69. a	70. a	71. b	72. b	73. a	74. c
75. c	76. a	77. c	78. a	79. d	80. c	81. a, b	82. b		

83. The function of the neocerebellum are-
a. Maintenance of equilibrium
b. Servo correction of voluntary movements
c. Planning and programming of voluntary movements
d. Maintenance of muscle tone

84. Pain receptors are found in –
a. Ventral horn
b. Dorsal horn
c. Substantia nigra
d. None of the above

85. All of the following are thermal modalities except-
a. Cold receptor b. Warm receptor
c. Pain receptor d. Stretch receptor

86. Which of the following sensations is most affected by cortical lesions-
a. Proprioception
b. Temperature
c. Itch
d. Crude touch

87. An anterolaternal corodotomy relieving pain in right leg is effective because it interrupts the –
a. Left dorsal column
b. Left ventral spinothalmic tract
c. Left lateral spinothalmic tract
d. Right lateral spinothalmic tract.

88. Beta waveforms in electroencephalogram designate which of the following states of the patient-
a. Deep Anaesthesia
b. Surgical Anaesthesia
c. Light Anaesthesia, eyes closed, relaxed
d. Awake/alert state

89. The first physiological response to high environmental temperature is-
a. Sweating
b. Vasodilatation
c. Decreased heat production
d. Non-shivering thermogenesis

90. The first reflex response to appear as spinal shock wears off in humans is-
a. Stretch
b. Withdrawal reflex
c. Neck righting reflex
d. Labyrinthine reflex

91. Functions of limbic system-
a. Emotions
b. Memory
c. Higher function
d. Planned motor activity.

92. Impotence is seen with which lesion of spinal cord?
a. Upper lumbar b. Lower sacral
c. Upper thoracicd. None.

93. Lesion in Wernicke's area results in-
a. Global aphasia
b. Non-fluent aphasia
c. Conduction aphasia
d. Failure of comprehension of spoken or written words.

94. Phantom limb phenomenon is explained by-
a. Law of projection
b. Webers law
c. Fechner's law of degeneration
d. Pascals law

95. EEG in a male fully awake with eyes closed, electrodes placed at occipital position will record:
a. α waves b. β waves
c. γ waves d. δ waves

96. The principle that is the spinal cord dorsal roots are sensory and the ventral roots are motor is known as–
a. Laplace's law
b. Bell-Magendle's law
c. Frank Starling's law
d. Weber-Fechner's law

97. The raphe nuclei located in lower pons and medulla secrete the following neurotransmitter-
a. Norepinphrine b. Dopamine
c. Serotonin d. Acetycholine

98. Broca's area is concerned with-
a. Word formation
b. Comprehension
c. Repetition
d. Reading

83. c	84. d	85. d	86. a	87. c	88. d	89. b	90. b	91. a	92. b
93. d	94. a	95. a	96. b	97. c	98. a				

99. The nucleus involved in Papez circuit is-
a. Pulvinar
b. Intralaminar
c. VPL nucleus
d. Anterior nucleus of Thalamus

100. The processing of short term memory to long term memory is done in-
a. Prefrontal cortex
b. Hippocampus
c. Neocortex
d. Amygdala.

101. Brown-sequard syndrome-
a. Pain loss in the opposite side of lesion
b. Fine touch lost in opposite side of lesion
c. UMN paralysis in opposite side of lesion
d. LMN paralysis in opposite side of lesion

102. Evacuation of the urinary bladder and stool with profuse sweating are features of-
a. Mass reflex
b. Positive supportive reaction
c. Labyrinthine righting reflex
d. Stretch reflex

103. Pyramids are formed by-
a. Arcuate nucleus
b. Vestibular nuclei
c. Interstitial cells of cajal
d. Lateral corticospinal tract.

104. Which of the following sensation are transmitted by the Dorsal tract/ Posterior column-
a. Fine touch b. Pain
c. Temperature d. All of the above

105. Regarding Golgi tendon organ true is –
a. Senses dynamic length of muscle
b. Involved in reciprocal innervation
c. α-motor neuron stimulation
d. Senses muscle tension

106. Posterior column lesion which of the following is not affected-
a. Vibration b. Temperature
c. Fine touch d. Position sense
e. Crude sense

107. All are true about olfaction except-
a. Key-lock system
b. Chemical mediated
c. Females have stronger sense of olfaction
d. Males have stronger sense of olfaction.

108. Limbic system is concerned with-
a. Control of emotions, food habits
b. Sexual behaviour
c. Autonomic functions
d. All of the above

109. Osmoreceptors are located in-
a. Supraoptic nuclei
b. Paraventricular nuclei
c. Anterior hypothalamus
d. Lateral hypothalamus.

110. Which of the following statements is true about presynaptic inhibition?
a. It results due to failure of the action potential to reach the synapse
b. It occurs due to hyperpolarisation of presynaptic membrane
c. It occurs due to inhibition of release of neurotransmitter from presynaptic terminal
d. It occurs due to blockade of neurotransmitter receptors.

111. Key regulators of sleep are located in-
a. Hypothalamus
b. Thalamus
c. Putamen
d. Limbic cortex.

112. True about spinocerebellar tract is-
a. Equilibrium
b. Smoothens and coordinates movement
c. Learning induced by change in vestibulocular reflex
d. Planning and programming

99. d	100. b	101. a	102. a	103. d	104. a	105. d	106. a, e	107. d
108. d	109. c	110. b, c	111. a	112. b				

113. Which of the following is true true about brown sequard syndrome?

a. Ipsilateral loss of joint sensation
b. Contralateral loss of joint sensation
c. Ipsilateral loss of pain & temperature
d. Segmental sign are bilateral

114. The function of the neocerebellum is-

a. Maintenance of equilibrium
b. Servo-correction of voluntary movements
c. Planning and programming of voluntary movements
d. Maintenance of muscle tone

115. The following is true about brain metabolism except-

a. Use fatty acid in starvation
b. In resting state 60% of total energy utilised
c. Ketone bodies are used in starvation
d. Has no energy store.

116. Simulation of post ganglionic sympathetic neurons leads to A/E-

a. Fast EPSP b. Slow EPSP
c. Fast IPSP d. Slow IPSP
e. LATE slow EPSP

117. Renshaw cell inhibition is :

a. Feedback facilitation
b. Feed forward inhibition
c. Feed forward facilitation
d. Feedback inhibition

118. The inverse stretch reflex is due to :

a. Trail fibre ending
b. Golgi tendon organ
c. Plate fiber ending
d. Muscle spindle

119. For sweat gland secretion, along with acetyl choline which of the following is released :

a. Neuro peptide Y
b. Enkephalin
c. Vaso active intestinal peptide
d. Substance P

120. Heat loss at an ambient temperature of 21 degree takes place through :

a. Respiration b. Radiation
c. Sweating d. Urine and feces

121. Myotactic reflex is carried by

a. Golgi tendon organ
b. Muscle spindle
c. Free nerve endings
d. C. Fibres

122. Receptor of joint capsule and ligament is :

a. Slow adapting
b. Fast adapting
c. Can be both slow and fast adapting
d. Non adapting

123. Monroe- Kellie doctrine is related to injury of :

a. Head b. Abdomen
d. Chest d. Leg

124. Neurotransmitter for pain is :

a. Dopamine b. Substance P
c. PAF d. None

125. Delta waves are seen in :

a. Wakefulness b. Deep sleep
c. Stage I REM d. None

126. Motor neuron to muscle spindle :

a. Alpha b. Gamma
c. Aβ d. None

127. Muscle spindle is a receptor for :

a. Stretch reflex
b. Antigravity muscle
c. Multisynaptic reflex
d. Stretch and contraction of muscle

128. Motor area in cerebrum is mainly associated with-

a. Performing all voluntary movements
b. Performing an involuntary movements
c. Executing fine movements
d. Controlling all motor activity

129. The following is a neurotransmitter-

a. Serine b. Glutathoine
c. Glutamine d. Aspartate

113. a	114. c	115. d	116. a,b,c,e	117. d	118. b	119. c	120. b	121. b
122. b	123. a	124. b	125. b	126. b	127. a	128. a	129. d	

130. The most important constitutent of endolymph is-

a. Sodium b. Potassium
c. Chloride d. Protein

131. EEG in paradoxical sleep is-

a. Low amplitude, mixed frequency
b. High amplitude, low frequency
c. Q-waves
d. Delta & Theta waves

132. In normal CSF, glucose is-

a. 2/3 blood level
b. 1/3 blood level
c. Equal to blood level
d. None of the above

133. "Spatial distortion" is common is disorders of-

a. Dominant parietal lobe
b. Non-dominant parietal lobe
c. Dominant temporal lobe
d. Non-dominant temporal lobe

134. Deja Vu is seen in-

a. Normal persons
b. Temporal lobe epilepsy
c. Psychosis
d. All of the above

135. The receptors of pain is-

a. Ruffini organs
b. Meckel's bodies
c. Golgi bodies
d. Free nerve endings

136. Inhibition of the spinal cord may be brought about by :

a. Glutamic acid b. Aspartic acid
c. Glycine d. strychinine

137. Lesion in which of the following leads to sensory ataxia :

a. Posterior column
b. Vermis
c. Floculo nodular lobe
d. Vestibular apparatus

138. Crude touch sensations are carried by:

a. Lateral spinothalamic tract
b. Ventral spinothalamic tract
c. Posterior columns
d. Pyramidal tracts

139. Damage to sensory area 1 of the cerebral cortex results in :

a. Loss of perception of pain
b. Loss of tactile and two point discrimination
c. Loss of perception of touch
d. Loss of only tactile discrimination

140. Swallowing centre is situated in :

a. Midbrain b. Pons
c. Medulla d. Cerebellum

141. Medial geniculate body is concerned with :

a. Hearing b. vision
c. Smell

142. Which substance evokes the umami taste sensation in humans :

a. Glucose b. Glutamate
c. Glucosamine d. Gelatin

143. Nuclear bag fiber detects -

a. Dynamic length of muscle
b. Involved in reciprocal innervations
c. Alpha motor neuron stimulation
d. Motor tension

144. Extrafusal fibre innervated by :

a. Ia b. Ib
c. Aα d. Aβ

145. Lewis' triple response is mediated by:

a. Histamine
b. Axon reflex
c. Injury to endothelium
d. None of the above

146. CSF pressure in the lying down posture is-

a. 20-50 mm of H_2O
b. 50-150 mm of H_2O
c. 150-200 mm of H_2O
d. 200-300 mm of H_2O

130. b	131. a	132. a	133. b	134. d	135. d	136. c	137. a	138. b
139. b	140. c	141. a	142. b	143. a	144. c	145. b	146. b	

147. CSF does not pass through-

a. Ventricles
b. Venous sinuses
c. Epidural spaces
d. Subarachnoid space

148. CSF is principally secreted by-

a. Choroid plexus
b. Arachnoid granulation
c. Floor of fourth ventricle
d. Periaqueductal grey

149. CSF production per day is-

a. 100 ml b. 200 ml
c. 300 ml d. 400 ml

150. Below _____ pressure, CSF absorption stops-

a. 60 mm CSF b. 68 mm CSF
c. 80 mm CSF d. 50 mm CSF

151. Volume of CSF is about :

a. 50 ml b. 100 ml
c. 150 ml d. 200 ml

152. All the following are more in CSF compared to plasma except :

a. Mg b. Cl
c. HCO_3 d. Glucose

147. c	148. a	149. d	150. b	151. c	152. b

11. **c) Optic disc**

(Ref- Ganong's Physiology 25th edition- page 180).

Explanation- The optic nerve leaves the eye at a point 3 mm medial to and slightly above the posterior pole of the globe. This region is visible through the ophthalmoscope as the optic disk (Figure 9–3). Since there are no visual receptors over the disk, this area of the retina does not respond to light and is known as the blind spot. Near the posterior pole of the eye, there is a yellowish pigmented spot called the macula. The

Fovea is in the center of the macula; it is a thinned-out, rod-free portion of the retina in humans and other primates. In it, the cones are densely packed, and each synapses on a single bipolar cell, which, in turn, synapses on a single ganglion cell, providing a direct pathway to the brain.

12. **c) Decreased sexual activity**

(Ref- Guyton's Physiology 13th edition- page 759).

Explanation- When the anterior parts of both temporal lobes are destroyed in a monkey, this procedure removes not only portions of temporal cortex but also of the amygdalas that lie inside these parts of the temporal lobes. This removal causes changes in behavior called the Klüver-Bucy syndrome, which is demonstrated by an animal that (1) is not afraid of anything, (2) has extreme curiosity about everything, (3) forgets rapidly, (4) has a tendency to place everything in its mouth and sometimes even tries to eat solid objects, and (5) often has a sex drive so strong that it attempts to copulate with immature animals, animals of the wrong sex, or even animals of a different species.

13. **a) Low amplitude mixed frequency**

(Ref- Ganong's Physiology 25th edition- page 274).

Explanation- The high-amplitude slow waves seen in the EEG during sleep are periodically replaced by rapid, low-voltage EEG activity, which resembles that seen in the awake, aroused state and in stage 1 sleep (Figure 14–7). For this reason, REM sleep is also called paradoxical sleep.

14. **c) Olfaction**

(Ref- Ganong's Physiology 25th edition- page 219).

Explanation- From cortex, amygdala, and entorhinal cortex (Figure 11–3), information travels directly to the frontal cortex or via the thalamus to the orbitofrontal cortex.

15. **c) Muscles of mastication**

(Ref- Ganong's Physiology 24th edition- page 175).

Explanation- For the somatosensory cortex, mouth, tongue and fingers have very large representation and trunk, arms and legs are tiny.

16. **b) Genitalia**

(Ref- Ganong's Physiology 24th edition- page 175).

17. **a) Relay centre**

Explanation- Thalamus is relay center for all sensations except olfaction.

18. **d)** Free nerve endings

(Ref- Guyton Physiology 13th edition- Table – 47.1- page 595).

19. **a) Spinal cord**

(Ref- Guyton Physiology 13th edition- Fig. 48.13- page 616).

20. **d) Acetyl choline.**

(Ref- Guyton Physiology 13th edition- page 88).

21. **b) Ventromedian nucleus of hypothalamus**

(Ref- Ganong's Physiology 24th edition- page 275).

22. **a) Posterior column**

(Ref- Guyton Physiology 13th edition- page 608).

23. **b) Ventral spinothalamic tract**

(Ref- Ganong's Physiology 24th edition- page 173).

24. **c) Stretch reflex**

(Ref- Ganong's Physiology 24th edition- page 247).

Explanation- Stretch reflex is fundamental to postural control.

25. a) Hypotonia

Ref. Richard S. Snell's Clinical Neuro-anatomy- page 182).

Explanation- Babinski sign (extensor plantar response) is a feature of pyramidal tract lesion.

26. c) Pyrogens act on hypothalamus

(Ref- Guyton Physiology 13th edition- page 879).

Explanation- One of the most important of these cytokines in causing fever is interleukin-1 (IL-1), also called leukocyte pyrogen or endogenous pyrogen. IL-1 is released from macrophages into the body fluids and, upon reaching the hypothalamus, almost immediately activates the processes to produce fever, sometimes increasing the body temperature a noticeable amount in only 8 to 10 minutes.

27. b) Loss of tactile and two-point discrimination

(Ref- Ganong's Physiology 24th edition- page 176).

Explanation- Graphesthesia and Stereognosis are lost earliest in SSI lesion. Proprioception and fine touch (Tactile localization) are most affected by cortical lesions.

28. d) Medulla

(Ref. Front Neuroendocrinol. 1994 Dec, 15: 301-20).

Explanation- Area postrema has been implicated as a chemoreceptor trigger zone for over 40 years. The AP is located on the dorsal surface of medulla oblongata at the caudal end of the fourth ventricle.

29. b) Substance P

(Ref- Ganong's Physiology 24th edition- page 169, Fig. 10.1).

Explanation- Substance P acts on mast cells to cause degranulation and release histamine which activates nociceptors.

30. c) Medulla

(Ref- Guyton Physiology 13th edition-Fig. 64.1- page 771).

31. b) Releasing interleukins

(Ref- Guyton Physiology 13th edition- page 879).

32. a) Hearing

(Ref- Guyton Physiology 13th edition- page 651).

Explanation- The primary auditory cortex is directly excited by projections from the medial geniculate body, whereas the auditory association areas are excited secondarily by impulses from the primary auditory cortex,

33. a) Lower 1/3 of nasal mucosa

(Ref- Guyton Physiology 13th edition- page 659).

Explanation- The mucosal end of the olfactory cell forms a knob from which 4 to 25 olfactory hairs (also called olfactory cilia), measuring 0.3 micrometer in diameter and up to 200 micrometers in length, project into the mucus that coats the inner surface of the nasal cavity.

34. a) Contraction of Skeletal muscle

(Ref- Guyton Physiology 13th edition- page 743).

Explanation- Nicotinic receptors are ligand-gated ion channels found in autonomic ganglia at the synapses between the preganglionic and postganglionic neurons of both the sympathetic and parasympathetic systems. (Nicotinic receptors are also present at many non-autonomic nerve endings—for instance, at the neuromuscular junctions in skeletal muscle.

35.

(Ref- Ganong's Physiology 24th edition- page 152).

Explanation- Intensity of stimulation is coded by frequency of AP in the sensory neuron. More the intensity of stimulus, more will be the frequency of AP, amplitude will not change(all or none law).

36. a) Dorsal columns

(Ref- Guyton Physiology 13th edition- page 609).

Explanation- Dorsal Column–Medial Lemniscal Pathway. Note in Figure 48-3 that nerve fibers entering the dorsal columns pass uninterrupted up to the dorsal medulla, where they synapse in the dorsal column nuclei (the cuneate and gracile nuclei). From there, second-order neurons decussate immediately to the opposite side of the brain stem and continue upward through the medial lemnisci to the thalamus.

37. c) Touch

(Ref- Ganong's Physiology 24th edition- page 151).

Explanation- Rapidly adapting touch receptors are- meissner's corpuscles, pacinian corpuscles and hair end organ.

38. a) Proprioception

(Ref- Ganong's Physiology 24th edition- page 173).

39. c) Rapid shallow breathing

(Ref- Ganong's Physiology 24th edition- page 232).

Explanation- It is well known that trying to pull the hands apart when the flexed fingers are hooked together facilitates the knee jerk reflex (Jendrassik maneuver), and this may also be due to increased γ-motor neuron discharge initiated by afferent impulses from the hands. Anxiety increases gamma efferent discharge.

40. b) Berger's Rhythm

(Ref. Comprehensive Textbook of Medical Physiology- GK Pal – page 843. 44).

Explanation- Hans Berger a German psychiatrist first time demonstrated recording of the electrical activity of the scalp using surface electrodes and called it as Berger Rhythm.

41. b) 4

(Ref- Ganong's Physiology 24th edition- Fig. 8.8 page 170).

42. d) All of the above

(Ref- Guyton Physiology 13th edition- page 850).

Explanation- The hypothalamus receives (1) neural signals from the gastrointestinal tract that provide sensory information about stomach filling; (2) chemical signals from nutrients in the blood (glucose, amino acids, and fatty acids) that signify satiety; (3) signals from gastrointestinal hormones; (4) signals from hormones released by adipose tissue; and (5) signals from the cerebral cortex (sight, smell, and taste) that influence feeding behaviour.

43. d) All of the above.

(Ref- Guyton Physiology 13th edition- page 664).

Explanation- These gamma motor neurons transmit impulses through much smaller type A gamma (Aγ) motor nerve fibers, averaging 5 micrometers in diameter, which go to small, special skeletal muscle fibers called intrafusal fibers. These fibers constitute the middle of the muscle spindle which controls the basic muscle tone.

44. a) Diminished use of contralateral appendages below the lesion

(Ref- Guyton Physiology 13th edition- page 681).

Explanation- The primary motor cortex normally exerts a continual tonic stimulatory effect on the motor neurons of the spinal cord; when this stimulatory effect is removed, hypotonia results. Most lesions of the motor cortex, especially those caused by a stroke, involve not only the primary motor cortex but also adjacent parts of the brain such as the basal ganglia. In these instances, muscle spasm almost invariably occurs in the afflicted muscle areas on the opposite side of the body(because the motor pathways cross to the opposite side).

45. a) Swallowing reflex

(Ref- Guyton Physiology 13th edition- page 672).

46. b) Receptor for stretch receptor reflex

(Ref- Ganong's Physiology 24th edition- page 158).

47. c) Delta

(Ref- Guyton Physiology 13th edition- page 733).

Explanation- Delta waves include all the waves of the EEG with frequencies less than 3.5 cycles/sec, and they often have voltages two to four times greater than most other types of
brain waves. They occur in very deep sleep, in infancy, and in persons with serious organic brain disease.

48. a) Anterior surface of cornea

(Ref- Guyton Physiology 13th edition- page 611).

Explanation- About two thirds of the 59 diopters of refractive power of the eye is provided by the anterior surface of the cornea (not by the eye lens). The principal reason for this phenomenon is that the refractive index of the cornea is markedly different from that of air, whereas the refractive index of the eye lens is not greatly different from the indices of the aqueous humor and vitreous humor.

49. d) Is bilaterally symmetrical

(Ref- Guyton Physiology 13th edition- page 732.33).

50. c) Layer 4

(Ref- Guyton Physiology 13th edition- page 679)

Explanation- The input signals all enter by way of layers 2 through 4, and the sixth layer gives rise
mainly to fibers that communicate with other regions of the cerebral cortex.

51. c) Inter collicular transection

(Ref- Guyton Physiology 13th edition- page 714).

Explanation- When the brain stem of an animal is sectioned below the midlevel of the mesencephalon but the pontine and medullary reticular systems, as well as the vestibular system, are left intact, a condition called decerebrate rigidity develops.

52. a) Decorticate rigidity is greater than decerebrate rigidity

(Ref- Ganong's Physiology 25th edition- page 244).

53. d) Spinal cord

(Ref- Ganong's Physiology 24th edition- page 247).

54. c) 8-13

(Ref- Ganong's Physiology 25th edition- page 273)

55. c) 50

(Ref- Ganong's Physiology 25th edition- page 273)

Explanation- c- In adult humans who are awake but at rest with the mind wandering and the eyes closed, the most prominent component of the EEG is a fairly regular pattern of waves at a frequency of 8–13 Hz and amplitude of 50–100 μV when recorded from the scalp. This pattern is the alpha rhythm.

56. c) Intensity discrimination

(Ref- Ganong's Physiology 24th edition- page 153).

Explanation- Magnitude of sensation is proportional to log of intensity of stimulus- (Weber Fechner Law).

57. d) 13-30

(Ref- Ganong's Physiology 25th edition- page 273).

58. b) Pain

(Ref- Guyton Physiology 13th edition- Table – 47.1- page 595).

59. a) Equilibrium

(Ref- Ganong's Physiology 25th edition- page 257)

Explanation- Vestibulocerebellum (or flocculonodular lobe) has vestibular connections and is concerned with equilibrium and eye movements.

60. c) Flocculonodular lobe of cerebellum

(Ref- Ganong's Physiology 24th edition- page 257).

Explanation- Vestibulocerebellum (or flocculonodular lobe) has vestibular connections and is concerned with equilibrium and eye movements.

61. a) Aphagia

(Ref- Guyton Physiology 13th edition- page 756).

Explanation- One area associated with hunger is the lateral hypothalamic area. Conversely, damage to this area on both sides of the hypothalamus causes the

animal to lose desire for food, sometimes causing lethal starvation.

62. e) None of the above.

63. c Anticipatory rise in heart rate

(Ref- Ganong's Physiology 24th edition- page 285).

Explanation- ANS is controlled by hypothalamus. But HR increase during exercise is mainly controlled by medulla.

64. c) Awake with eyes closed

(Ref- Ganong's Physiology 24th edition- page 233).

Explanation- Alpha wave is seen when the person is awake, in a quiet, resting state of cerebration. Mental work will convert alpha to beta wave. Light sleep will convert alpha to theta wave.

65. b) Tractus cuneatus

66. c) Theta-wave

(Review of clinical electroencephalography by G.R. Shamsaei, pp10).

Explanation- Theta wave is seen in cortex (human) and hippocampus (in non-human mammals).

67. d) CO_2

Explanation- Gases can easily cross BBB but not ions.

68. a) Supra chiasmatic nucleus

(Ref- Ganong's Physiology 24th edition- page 352).

Explanation- Many endogenous body activities have rhythmic fluctuations that are approximately 24 h in length, that is they are circadian. This rhythm is controlled by suprachiasmatic nucleus.

69. a) Olfactory

olfactory neuron is a pseudo unipolar neuron, in which peripheral processes reach sensory receptors.

70. a) Anterior hypothalamus

(Ref- Ganong's Physiology 24th edition- page 666).

Explanation- Vasopressin secretion is regulated by osmoreceptors located in anterior hypothalamus.

71. b) Postural reflex

(Ref- Ganong's Physiology 25th edition- page 234).

Explanation- Flexor responses can be produced by innocuous stimulation of the skin or by stretch of the muscle, but strong flexor responses with withdrawal are initiated only by stimuli that are noxious or at least potentially harmful (ie, nociceptive stimuli). The withdrawal reflex serves a protective function as flexion of the stimulated limb gets it away from the source of irritation, and extension of the other limb supports the body.

72. b) Reticular activating system

(Ref- Ganong's Physiology 25th edition- page 271).

Explanation- The reticular formation plays an important role in determining the level of arousal, thus it is called the ascending reticular activating system (RAS).

73. a) Cl^- influx

(Ref- Ganong's Physiology 24th edition- page 120).

Explanation- IPSP is mediated by Cl- influx in cell. They can also be produced by opening of K+ channels, with movement of K+ out of the postsynaptic cell.

74. c) Na^+ influx

(Ref- Ganong's Physiology 24th edition- page 120).

Explanation- Na+ influx >> Ca2+ influx, the excitatory transmitter opens Na+ or Ca2+ ion Ref- Ganong's Physiology 25th edition-page 271).

75. c) Cortical association

(Ref- Ganong's Physiology 24th edition- page 242, Fig. 16.1).

Explanation- Commands for voluntary movements originate in cortical association areas.

76. a) Pyramidal cells

(Ref- Ganong's Physiology 24th edition- page 243).

Explanation- Lower motor neurons refer to the spinal and cranial motor neurons that directly innervate skeletal muscles. Upper motor neurons are those in the cortex and brainstem that activate lower motor neurons.

77. c) Olfaction

78. a) Substantia gelatinosa

(Ref- Ganong's Physiology 24th edition- page 177).

Explanation- Gate control theory operates at dorsal horn of spinal cord (not dorsal root ganglion), in lamina I to IV.

79. c) Ventromedical anterior hypothalamus

(Ref- Ganong's Physiology 24th edition- page 285).

Explanation- Response to cold environment is controlled by posterior hypothalamus.

80. c. The back of scapula

81. a) Increased Angitension II level

b) Extracellular hypersmolarity

(Ref. Guyton's Physiology 12th edition, pp 735).

Explanation- Ang-II stimulates sub fornical organ and stimulates thirst and increase in extracellular osmolarity can stimulate preoptic nucleus and can produce thirst.

82. b) Dopamine

(Ref- Ganong's Physiology 24th edition- page 251).

83. c) Planning and programming of voluntary movements

(Ref- Ganong's Physiology 24th edition- page 257).

Explanation- Spinocerebellum by comparing plan with performance, smoothens and coordinates movements. Neocerbellum for planning and programming.

84. d) None of the above

Explanation- Pain Receptors Are Free Nerve Endings. The pain receptors in the skin and other tissues are all free nerve endings. They are widespread in the superficial layers of the skin, as well as in certain internal tissues, such as the periosteum, the arterial walls, the joint surfaces, and the falx and tentorium in the cranial vault.

85. d) Stretch receptor

(Ref- Ganong's Physiology 24th edition- page 168).

Explanation- Pain receptor can also detect hot (burning pain , temp.. > 49c) and cold (freezing pain , temp.. < 5c).

86. a) Proprioception

(Ref- Ganong's Physiology 24th edition- page 176).

Explanation- Proprioception is most affected in lesions of cerebral cortex.

87. c) Left lateral spinothalmic tract

(Ref- Ganong's Physiology 24th edition- page 174).

Explanation- Pain and temperature are carried by lateral spinothalamic tract. This tract crosses obliquely to the opposite segment within one spinal segment and ascend in the opposite anterolateral white column as the lateral spinothalamic tract. So, pain from the right leg is relieved by cutting left lateral spinothalamic tract.

88. d) Awake/alert state

(Ref- Ganong's Physiology 24th edition- page 233).

Explanation- When attention is focused on something, alpha rhythm is replaced by an irregular 13-30 Hz low voltage activity, the beta rhythm.

89. b) Vasodilatation

(Ref- Guyton's Physiology 12th edition- page 895).

Explanation- First response is vasodilation followed by sweating.

90. b) Withdrawal reflex

(Ref- Ganong's Physiology 24th edition- page 250).

Explanation- The first response to appear as spinal shock wears off in humans is often a slight contraction of the leg flexors and adductors in response to noxious stimulus.

91. **a) Emotions**

(Ref- Guyton's Physiology 12th edition- page 738).

Explanation- Emotions >> Higher function. Amygdala controls emotions.

92. **b) Lower sacral**

- (Ref- Guyton's Physiology 12th edition- Fig. 26.7- page 327).

93. **d) Failure of comprehension of spoken or written words.**

(Ref- Ganong's Physiology 25th edition- page 293).

Explanation- In one form of fluent aphasia, the lesion is in Wernicke area. In this condition, speech itself is normal and sometimes the patients talk excessively. However, what they say is full of jargon and neologisms that make little sense. The patient also fails to comprehend the meaning of spoken or written words, so other aspects of the use of language are compromised.

94. **a) Law of projection**

(Ref- Ganong's Physiology 24th edition- page 155).

Explanation- No matter where a particular sensory pathway is stimulated along its course to the cortex , the conscious sensation produced is referred to the location of the receptor. This principle is called the law of projection. Phantom limb sensation is an example of this.

95. **a) α waves**

(Ref- Ganong's Physiology 24th edition- page 233).

Explanation- Alpha rhythm is most marked in parietal and occipital lobes and is associated with decreased levels of attention.

96. **b) Bell-Magendle's law**

(Ref- Ganong's Physiology 24th edition- page 158).

Explanation- The principle that in the spinal cord dorsal roots are sensory and ventral roots are motor is known as Bell Magendie Law.

97. **c) Serotonin**

(Ref- Ganong's Physiology 25th edition- page 308).

Explanation-Serotonin-secreting neurons project to the hypothalamus from the raphe nuclei.

98. **a) Word formation**

(Ref- Ganong's Physiology 25th edition- page 293).

Explanation- Broca area processes the information into a detailed and coordinated pattern for vocalization and then projects the pattern via a speech articulation area in the insula to the motor cortex, which initiates the appropriate movements of the lips, tongue, and larynx to produce speech.

99. **d) Anterior nucleus of Thalamus**

(Ref: Comprehensive Textbook of Physiology ist edition, GK Pal, pp 826).

Explanation- Anterior nucleus of thalamus is a constituent of Papez circuit. It receives input form the mamillary body of limbic system via mammillothalamic tract. Through this connection, thalamus is concerned with recent memory and emotion.

100. **b) Hippocampus**

(Ref. Guyton's Physiology 12th edition- pp 726)

, people have virtually no capacity for storing verbal and symbolic types of memory (declarative types of memory) in long term memory or even in intermediate memory lasting longer than few minutes.

101. **a Pain loss in the opposite side of lesion**

(Ref- Ganong's Physiology 24th edition- page 177).

Explanation- Brown sequard syndrome is due to hemisection of spinal cord. This leads to ipsilateral loss of discriminative touch, vibration and proprioception below the level of lesion. The loss of the spinothalamic tract leads to contralateral loss of pain and temperature sensation beginning one or two segments below the lesion. Damage to corticospinal tract (UMN) produces weakness and spasticity in certain muscles on the same side of the body.

102. a) Mass reflex

(Ref- Ganong's Physiology 25th edition- page 235).

Explanation- Stretch reflexes are also hyperactive. Afferent stimuli irradiate from one reflex center to another after SCI. When even a relatively minor noxious stimulus is applied to the skin, it may activate autonomic neurons and produce evacuation of the bladder and rectum, sweating, pallor, and blood pressure swings in addition to the withdrawal response. This distressing mass reflex can however sometimes be used to give paraplegic patients a degree of bladder and bowel control.

103. d) Lateral corticospinal tract.

(Ref- Ganong's Physiology 24th edition- page 242).

Explanation- About 80% (average) of the corticospinal fibers cross the midline in the medullary pyramids to form the lateral corticospinal tract.

104. a) Fine touch

(Ref- Ganong's Physiology 24th edition- page 173).

105. d) Senses muscle tension

(Ref- Ganong's Physiology 24th edition- page 162).

Explanation- Golgi tendon organs are in series with the muscle fibers, they are stimulated by both passive stretch and active contraction of the muscle, when tension increases inside muscle.

106. a) Vibration

e) Crude sense

(Ref- Ganong's Physiology 24th edition- page 173).

107. d) Males have stronger sense of olfaction.

(Ref- Ganong's Physiology 25th edition- page 219).

Explanation- The sense of smell is said to be more acute in women than in men, and in women it is most acute at the time of ovulation.

108. d) All of the above

(Ref- Guyton's Physiology 12th edition- page 738).

109. c) Anterior hypothalamus

(Ref- Ganong's Physiology 24th edition- page 666).

Explanation- Vasopressin secretion is regulated by osmoreceptors located in anterior hypothalamus.

110. b) It occurs due to hyperpolarisation of presynaptic membrane

c) It occurs due to inhibition of release of neurotransmitter from presynaptic terminal

(Ref- Ganong's Physiology 24th edition- page 122).

Explanation- Both b & c are correct but c is the final step. Ans also there is evidence for direct inhibition of transmitter release independent of Ca2+ influx into the excitatory ending

111. a) Hypothalamus

(Ref- Ganong's Physiology 24th edition- page 237).

112. b) Smoothens and coordinates movement

(Ref- Ganong's Physiology 24th edition- page 257).

Explanatioin-Spinocerebellum smoothens and coordinates movements.

113. a) Ipsilateral loss of joint sensation

(Ref- Ganong's Physiology 24th edition- page 177).

114. c) Planning and programming of voluntary movements

Ref- Ganong's Physiology 24th edition- page 257).

Explanation- Neocerebellum planning and programming movement.

115. d) Has no energy store.

(Ref- Guyton's Physiology 12th edition- page 791).

116. a) Fast EPSP

b) Slow EPSP

c) Fast IPSP

e) LATE slow EPSP

(Ref. Goodman & Gillman The Pharmacological Basis of Theraupetics, 12th edition, pp 269).

Explanation- Ach in ganglion causes fast EPSP, followed by fast IPSP, slow EPSP and late slow EPSP.

117. d) Feedback inhibition

(Ref- Ganong's Physiology 24th edition- page 121).

Explanation- Renshaw cell inhibition at spinal motor neuron is recurrent or feedback inhibition.

118. b) Golgi tendon organ

(Ref- Ganong's Physiology 24th edition- page 162).

119. c) Vaso active intestinal peptide

(Ref- Ganong's Physiology 24th edition- page 264).

Explanation- Vasoactive intestinal polypeptide (VIP), calcitonin gene-related peptide (CGRP), or substance P are co-released with acetylcholine from the sympathetic innervation to sweat glands (sudomotor fibers). VIP is co-localized with acetylcholine in many cranial parasympathetic postganglionic neurons supplying glands.

120. b) Radiation

(Ref- Ganong's Physiology 24th edition- page 284).

121. b) Muscle spindle

(Ref- Ganong's Physiology 25th edition- page 231).

122. b) Fast adapting

(Ref. Phys. Ther. 1982; 62: 22-29).

Explanation- Most of the receptors are slow adapting although fast adapting receptors are there.

123. a) Head

(Ref- Ganong's Physiology 25th edition- page 607).

Explanation- In adults, the brain, spinal cord, and spinal fluid are encased, along with the cerebral vessels, in a rigid bony enclosure. The cranial cavity normally contains a brain weighing approximately 1400 g, 75 mL of blood, and 75 mL of spinal fluid. Because brain tissue and spinal fluid are essentially incompressible, the volume of blood, spinal fluid, and brain in the cranium at any time must be relatively constant (Monro-Kellie doctrine).

124. b) Substance P

(Ref- Ganong's Physiology 24th edition- page 169- Fig. 10.1).

Explanation- Tissue injury releases bradykinin and prostaglandins that sensitize or activate nociceptors, which in turn releases substance P and calcitonin gene- related peptide (CGRP). Substance P acts on mast cells to cause degranulation and release histamine which activates nociceptors.

125. b) Deep sleep

126 b) Gamma

(Ref- Ganong's Physiology 24th edition- page 158).

Explanation- Gamma motor neuron is the efferent supply to muscle spindle.

127. a) Stretch reflex

(Ref- Ganong's Physiology 25th edition- page 229).

Explanation- When a skeletal muscle with an intact nerve supply is stretched, it contracts. This response is called the stretch reflex or myotatic reflex. The stimulus that initiates this reflex is stretch of the muscle, and the response is contraction of the muscle being stretched. The sense organ is a small encapsulated spindlelike or fusiform-shaped structure called the muscle spindle, located within the fleshy part of the muscle.

128. a) Performing all voluntary movements

(Ref- Ganong's Physiology 24th edition- page 242, Fig. 16.1).

129. d) Aspartate

(Ref- Ganong's Physiology 24th edition- page 138).

Explanation- Aspartate and Glutamate are both excitatory neurotransmitter in CNS. But Glutamate is major first excitatory neurotransmitter.

130. b) Potassium

(Ref- Ganong's Physiology 25th edition- page 200).

Explanation- The membranous labyrinth more or less duplicates the shape of the bony channels and is filled with a K+-rich fluid called endolymph.

131. a) Low amplitude, mixed frequency

(Ref. Review of Clinical Electroencephalography by G.R. Shamsaei, pp10).
Explanation- EEG background activity changes from that seen in slow wave sleep to faster and lower voltage activity (theta and beta), resembling wakefulness. So, in REM sleep (paradoxical sleep) it is beta like ie. low amplitude and mixed frequency.

132. a) 2/3 blood level

(Ref- Ganong's Physiology 25th edition Table 33.2 -page 603).

133. b) Non-dominant parietal lobe

(Ref- Guyton's Physiology 13th edition- page 662- Fig. 52.3).
Explanation- Note that the signals representing form, third-dimensional position, and motion are transmitted mainly into the superior portions of the occipital lobe and posterior portions of the parietal lobe. By contrast, the signals for visual detail and color are transmitted mainly into the anteroventral portion of the occipital lobe and the ventral portion of the posterior temporal lobe.

134. d) All of the above

(Ref- Ganong's Physiology 25th edition page 289).
Explanation- An inappropriate feeling of familiarity with new events or in new surroundings is known clinically as the déjà vu phenomenon, from the French words meaning "already seen." The phenomenon occurs from time to time in healthy individuals, but it also may occur as an aura (a sensation immediately preceding a seizure) in patients with temporal lobe epilepsy.

135. d) Free nerve endings

(Ref- Ganong's Physiology 25th edition page 160).

136. c) Glycine

(Ref- Ganong's Physiology 24th edition, page 142).

137. a) Posterior column

Explanation- posterior column carries sensations of fine touch and proprioception, so lesions of this tract leads to sensory ataxia – it is a form of ataxia (loss of coordination) caused not by cerebellar dysfunction but by loss of sensory input into the control of movement.

138. b) Ventral spinothalamic tract

(Ref- Ganong's Physiology 24th edition, page 175).

139. b) Loss of tactile and two point discrimination

(Ref- Ganong's Physiology 24th edition, page 176).

140. c) Medulla

(Ref- Guyton's Physiology 13th edition, page 808).
Explanation- The sequence of the swallowing reflex is the same from one swallow to the next, and the timing of the entire cycle also remains constant from one swallow to the next. The areas in the medulla and lower pons that control swallowing are collectively called the deglutition or swallowing center.

141. a) Hearing

(Ref- Guyton's Physiology 13th edition, page 678).

142. b) Glutamate

(Ref- Ganong's Physiology 25th edition, page 222).
Explanation- The umami taste was added to the four classic tastes relatively recently, but it has been known for almost 100 years. It became established as a taste modality once its receptor was identified. It is triggered particularly by the monosodium glutamate (MSG) used so extensively in Asian cooking.

143. a) Dynamic length of muscle

(Ref- Ganong's Physiology 24th edition, page 158).
Explanation- Ia afferents (primary endings) are very sensitive to velocity of change in muscle length during a stretch (dynamic response).

144. c) Aα

(Ref- Ganong's Physiology 24th edition, page 158).

145. b) Axon reflex

(Ref- Ganong's Physiology 24th edition, page 613).

Explanation- This three-part response—the red reaction, wheal, and flare—is called the triple response and is part of the normal reaction to injury (see Chapter 3). It persists after total sympathectomy. On the other hand, the flare is absent in locally anesthetized skin and in denervated skin after the sensory nerves have degenerated, but it is present immediately after nerve block or section above the site of the injury. This, plus other evidence, indicates that it is due to an axon reflex, a response in which impulses initiated in sensory nerves by the injury are relayed antidromically down other branches of the sensory nerve fibers (Figure 33–14).

146. b) 50-150 mm of H_2O

(Ref. Ganong's Physiology 25th edition – pp- 603).

Explanation- Lumbar CSF pressure is normally 70–180 mm H2O. Up to pressures well above this range, the rate of CSF formation is independent of intraventricular pressure. However, absorption is proportional to the pressure (Figure 33–3). At a pressure of 112 mm H2O, which is the average normal CSF pressure, filtration and absorption are equal. Below a pressure of approximately 68 mm H2O, absorption stops.

147. c) Epidural spaces

(Ref. Ganong's Physiology 25th edition – pp- 603).

Explanation- It has been estimated that 50–70% of the CSF is formed in the choroid plexuses and the remainder is formed around blood vessels and along ventricular walls. The CSF in the ventricles flows through the foramens of Magendie and Luschka to the subarachnoid space and is absorbed through the arachnoid villi into veins, primarily the cerebral venous sinuses.

148. a) Choroid plexus

(Ref. Ganong's Physiology 25th edition – pp- 603).

Explanation- It has been estimated that 50–70% of the CSF is formed in the choroid plexuses and the remainder is formed around blood vessels and along ventricular walls

149. d) 400 ml

(Ref. Ganong's Physiology 25th edition – pp-603).

Explanation- CSF fills the ventricles and subarachnoid space. In humans, the volume of CSF is about 150 mL and the rate of CSF production is about 550 mL/d. Thus the CSF turns over about 3.7 times a day.

150. b) 68 mm CSF

(Ref. Ganong's Physiology 25th edition – pp-603).

Explanation- Lumbar CSF pressure is normally 70–180 mm H2O. Up to pressures well above this range, the rate of CSF formation is independent of intraventricular pressure. However, absorption is proportional to the pressure. At a pressure of 112 mm H2O, which is the average normal CSF pressure, filtration and absorption are equal. Below a pressure of approximately 68 mm H2O, absorption stops.

151. c) 150 ml

(Ref. Ganong's Physiology 25th edition – pp- 603).

Explanation- In humans, the volume of CSF is about 150 mL and the rate of CSF production is about 550 mL/d. Thus the CSF turns over about 3.7 times a day.

152. b) Cl

(Ref. Ganong's Physiology 25th edition – Table- 33.3- pp- 603).

Endocrinology and Reproductive System – Questions

Q1. Somatomedin mediates –
a. Deposition of chondroitin sulfate
b. Lipolysis
c. Gluconeogenesis
d. Decreased rate of glucose uptake by cells

Q2. Thyroid hormone acts through receptors present on –
a. Cell membrane
b. Cytoplasmic membrane
c. Nuclear membrane
d. DNA

Q3. cAMP action mediates all except-
a. Glucagon
b. Follicle stimulating hormone
c. Leutinizing hormone
d. estrogen

Q4. All of the following are increased in Acute stress EXCEPT-
a. Growth hormone
b. Insulin
c. Epinephrine
d. Glucagon

Q5. Which set of hormones have nuclear receptor-
a. Estrogen, thyroxin & glucagon
b. Estrogen, thyroxin & TSH
c. Estrogen, TSH & Gonadotropin releasing hormone (GnRH)
d. Retinoic acid, thyroxin & Luteinizing hormone (LH)
e. Testosterone, cortisol & Estrogen

Q6. Which one of the following hormones decreases Na^+-K^+ AT-Pase activity-
a. Thyroid hormone
b. Aldosterone
c. Dopamine
d. Insulin.

Q7. Which of the following acts through tyrosine kinase receptor-
a. Insulin
b. Glucagon
c. Growth hormone
d. Follicle stimulating hormone

Q8. Decreased hypothalamic function causes depressed levels of all of following hormones except-
a. Growth hormone
b. Prolactin
c. TSH
d. ACTH

Q9. Following are local hormones except-
a. Insulin b. Heparin
c. Bradykinin d. Acetyl choline

Q10. Capacitance of sperms takes place in–
a. Seminiferous tubules
b. Epididymis
c. Vas deference
d. Uterus

Q11. Which of the following have natriuretic actions –
a. Aldosterone
b. Atrial natriuretic peptide
c. Angiotensin
d. Prednisolone

Q12. Anabolic action on protein mediated by-
a. ACTH b. Insulin
c. Testosterone d. TSH

Q13. An adolescent desirous of increasing his muscle mass is advised to –
a. Increase protein intake
b. Take steroids
c. Perform isometric exercises
d. Electrically stimulate the muscle

1. a	2. c	3. d	4. b	5. e	6. c	7. a	8. b	9. a	10. d
11. b	12. c	13. c							

Q14. Which of the following is not stored in cells?

a. Insulin
b. Cortisol
c. Thyroxin
d. Renin

Q15. Role of liver in vitamin D metabolism:

a. Catalyzes rate
b. I- hydroxylation
c. 25- hydroxylation
d. 24- hydroxylation

Q16. Spermatogenesis occurs properly at which temperature :

a. Slightly higher than body temperature
b. Equal to body temperature
c. Slightly lower than body temperature
d. At any temperature closer to body temperature

Q17. Vasopressin secretion is increased by-

a. Alcohol
b. Decreased ECF volume
c. Carbamazepine
d. Procainamide

Q18. The fibre which is the thickest in human nerve is-

a. Touch
b. Pain
c. Temperature
d. Proprioception

Q19. Melatonin is secreted by :

a. Hypothalamus
b. adrenal cortex
c. Pineal gland
d. Melanocytes

Q20. Catecholamines :

a. Decrease gut contraction
b. Bronchoconstriction
c. Decrease plasma glucose
d. Inhibit lipolysis

Q21. Intracellular receptors are found in-

a. Insulin
b. Glucagon
c. Corticosteriods
d. Androgen
e. Thyroxine

14. b	15. c	16. c	17. b	18. d	19. c	20. a	21. c, d, e

10. d) Uterus

(Ref: Ganong's Physiology, 25th edition, page 419).

Explanation- Capacitation starts in cervix and ends at isthmus of fallopian tube.

11. b) Atrial natriuretic peptide

(Ref: Ganong's Physiology, 25th edition, fig. 37-1, page 689).

12. c) Testosterone

(Ref: Ganong's Physiology, 25th edition, page 423).

Explanation- Androgens increase the synthesis and decrease the breakdown of protein, leading to an increase in the rate of growth. It used to be argued that they cause the epiphyses to fuse to the long bones, thus eventually stopping growth, but it now appears that epiphysial closure is due to estrogens.

13. c) Perform isometric exercises

Best answer is to perform isometric exercise - as only increasing protein intake will not help, also steroids will cause osteoporosis.

14. b) Cortisol

Cortisol is not stored inside cells, rest all are synthesized and stored in cells and released as and when required.

15. c) 25- hydroxylation

(Ref: Ganong's Physiology, 25th edition, page 377).

Explanation- 25 – OH occurs in liver and 1- α OH occurs in kidney.

16. c) Slightly lower than body temperature

(Ref: Ganong's Physiology, 25th edition, page 426).

Explanation- Spontaneous descent of the testes is the rule, and the proportion of boys with undescended testes (cryptorchidism) falls to 2% at age 1 year and 0.3% after puberty. However, early treatment is now recommended despite these figures because the incidence of malignant tumors is higher in undescended than in scrotal testes and because after puberty the higher temperature in the abdomen eventually causes irreversible damage to the spermatogenic epithelium.

17. b) Decreased ECF volume

(Ref: Ganong's Physiology, 25th edition, page 695).

Explanation- When the effective osmotic pressure of the plasma rises, vasopressin secretion is increased and the thirst mechanism is stimulated; water is retained in the body, diluting the hypertonic plasma; and water intake is increased.

18. d) Proprioception

(Ref: Ganong's Physiology, 25th edition, Table 4-1, page 94).

Explanation- Aα is thickest and carries proprioception, it has maximum diameter.

19. c) Pineal gland

d- (Ref: Ganong's Physiology, 25th edition, Fig. 14.10, page 278).

20. a) Decrease gut contraction

Catecholamines decrease gut motility and contraction, these cause bronchodilation, increase plasma glucose by inhibition of insulin secretion via α1 receptor (dominant action) and increase lipolysis.

21. c) Corticosteriods

d) Androgen

e) Thyroxine

(Ref: Biochimica et Biophysica Acta 2005:1745:382-89 & William's Textbook of Endocrinology 12th edition).

Explanation- both nuclear and cytoplasmic will be intracellular receptors.

Gastrointestinal Tract – Questions

Q1. The rate of absorption of sugars by small intestine is highest for-

a. Disaccharides b. Polysaccharides
c. Hexoses d. Pentose

Q2. Which of the following is not secreted by the pancreas-

a. Procarboxypeptidase
b. Trypsinogen
c. Phospholipase A
d. Pepsinogen

Q3. Liver does not produce-

a. Albumin b. Gamma globulin
c. Fibrinogen d. Prothromobin

Q4. Gastrin secretion by polyric antrum is stimulated by-

a. Cholecystokinin
b. Alteration in pH of gastric contents
c. Distension of antrum
d. All of the above

Q5. Chymotrypsinogen in activated into chymotrypsin by-

a. Trypsin b. Pepsin
c. Fatty acids d. Bile salts

Q6. Most potent stimulus for bile secretion is

a. Cholecystokinin b. Gastrin
c. Secretin d. Bile acid
e. Bile salt

Q7. Secretin does not cause –

a. Bicarbonate secretin
b. Auguments the action of CCK
c. Contraction of pyloric sphincter
d. Gastric secretion increase.

Q8. Fat is maximally absorbed in –

a. Ileum b. Colon
c. Stomach d. Jejunum

Q9. Gastric secretion is-

a. Inhibited by curare
b. Stimulated by nor adrenaline
c. Increased by stomach distention
d. Stimulated by an increase in tonic activity

Q10. Maximum absorption of bile occurs at–

a. Jejunum b. Duodenum
c. Ileum d. Colon

Q11. Small intestinal peristalsis is controlled by-

a. Myenteric piexus
b. Meissner's piexus
c. Vagus nerve
d. Para sympathetic system

Q12. All are actions of CCK except-

a. Relax lower esophageal sphincter
b. Increased pancreatic secretion
c. Increased gastric secretion
d. Causes GB contraction

Q13. Actions of cholecystokinin include all of the following except-

a. Contraction of gall bladder
b. Secretion of pancreatic juice rich in enzymes
c. Increases the secretion of enterokinase
d. Stimulates gastric emptying

Q14. Stimulation for gastric emptying-

a. Secretin b. CCK
c. Gastrin d. Distension

Q15. Which of the following does not stimulate enterogastric reflex?

a. Products of protein digestion in the duodenum
b. Duodenal distension
c. H + ions bathing duodenal mucosa
d. Hormones

1. c	2. d	3. b	4. d	5. a	6. e	7. d	8. d	9. c	10. c
11. b	12. a	13. d	14. c	15. d					

Q16. Short chain fatty acid produced by bacteria are maximally absorbed in –

a. Duodenum b. Colon
c. Ileum d. Jejunum

Q17. Following are gastrointestinal hormones except-

a. CCK-PZ b. GIP
c. Motilin d. Chymotrypsin

Q18. All of the following are required for digestion of dietary fat except-

a. Bile pigments b. Colipase
c. Bile salts d. Pancreatic lipase

Q19. HCL secretion is stimulated by-

a. Secretin b. Somatostatin
c. Histamine d. Gastrin

Q20. Maximum contraction of gall bladder is seen with-

a. CCK b. Secretin
c. Gastrin d. Enterogastrone

Q21. True about secretin is –

a. Increased gall-bladder contraction and HCO_3 rich pancreatic fluid
b. Increased gastrin secretion
c. Gastric hypermotility
d. Increased enzyme rich pancreatic fluid

Q22. Which one of the following is the primary site of production of gastrin-

a. Pylorus b. Antrum
c. Pancreas d. Small intestine

Q23. Intrinsic factor is secreted by-

a. G-cells
b. Pepsinogen secreting cells
c. Parietal or oxyntic cells
d. Pyloric glands

Q24. Salivary amylase is activated by-

a. Na^+ b. K^+
c. HCO_3 d. Cl

Q25. Mass movement of the colon would be abolished by-

a. Extrinsic denervation
b. Distension of the colon
c. Gastrocolic reflex
d. Destruction of auerbach's plexus

Q26. All are true about migrating motor complex-

a. Occurs during fasting
b. Begins in the body of the stomach
c. Motilin secreted by Mo cells in the small intestine is responsible
d. Occurs at a rate of 5 cms per second from the stomach.

Q27. Which of the following secretions has a very high pH-

a. Gastric juice
b. Pancreatic juice
c. Bile in gall bladder
d. Saliva

Q28. Which of the following parameter will be increased after hepatectomy-

a. Glucose
b. Fibrinogen
c. Estrogen
d. Conjugated bilirubin

Q29. Micelles is formed by-

a. Triacylglycerol in polar solvent
b. Amphipathic lipids in water
c. Triacyl glycerol in gut
d. Cholesterol esters.

Q30. In the stomach, H+ ions are secreted in exchange for –

a. Na^+ b. K^+
c. Ca^+ d. Cl^-

Q31. Bile acids are synthesized from –

a. Cholesterol b. Amino acids
c. Bilirubin d. Protein

Q32. Iron is actively absorbed in-

a. Stomach
b. Duodenum and proximal jejunum
c. Large intestine
d. Ileum

Q33. Function of Kupffer cells in liver is-

a. Phagocytic b. Lytic
c. Secretory d. Excretory

Q34. Glucose transport occurs with the help of which following ion in absorption in gut region-

a. Na^+ b. K^+
c. Ca^+ d. Cl^-

16. b	17. d	18. a	19. c	20. a	21. a	22. b	23. c	24. d	25. d
26. d	27. b	28. c	29. b	30. b	31. a	32. b	33. a	34. a	

Q35. Which of the following inhibits gastric secretion and motility-

a. Vasoactive intestinal poly peptide (VIP)
b. Gastric inhibitory peptide (GIP)
c. Somatostatin
d. Ghrelin

Q36. All are endo peptidases except-

a. Trypsin
b. Chymotrypsin
c. Elastase
d. Carboxy peptidases.

Q37. In infants, defecation often follows a meal. The cause of colonic contractions in this situation is-

a. Gastroileal reflex
b. Enterogastric reflex
c. Increased circulating levels of CCK
d. Gastrocolic – reflex

Q38. Motilin is secreted by cells in-

a. Stomach b. Duoderum/ileum
c. Pancreas d. Liver

Q39. Maximum postprandial motility is seen in-

a. Ascending colon
b. Transverse colon
c. Descending colon
d. Sigmoid colon

Q40. Maximum potassium ions secretion is seen in –

a. Saliva
b. Gastric secretions
c. Jejunal secretions
d. Colonic secretions

Q41. The mechanism involved in the absorption of glucose from the small intestine is-

a. Passive diffusion
b. Facilitated diffusion
c. Secondary active cotransport with sodium
d. Actively by insulin dependent uptake

Q42. Gastric secretion of H^+ ions-

a. Is by chief cells
b. Is regulated in part by number of H^+ pumps
c. Is enhanced by carbonic anhydrase inhibitors
d. Occurs in exchange for luminal Na^+ ions

Q43. Highest concentration of potassium is seen in-

a. Colonic secretions
b. Pancreatic juice
c. Ileal secretions
d. Bile

Q44. Maximum water reabsorption in the Gastrointestinal tract occurs in-

a. Stomach b. Jejunum
c. Ileum d. Colon

Q45. Which of the following has serous secretion :

a. Pancreas
b. Parotid gland
c. Sub mandibular salivary gland
d. Minor salivary gland

Q46. In motor migration complex what is rate of migration :

a. 5 cm/ min every 60 minutes
b. 5 cm/ min every 90 minutes
c. 10 cm/ min every 60 minutes
d. 10 cm/ min every 90 minutes

Q47. The major ejection force in vomiting is provided by :

a. Stomach
b. Reverse peristalsis of intestines
c. Diaphragm
d. Abdominal muscles

Q48. Pancreatic secretion contains :

a. Trypsin
b. Lipase
c. Enteropeptidase
d. Pepsin
e. Renin

Q49. Chymotrypsinogen in activated into chymotrypsin by :

a. Trypsin b. Pepsin
c. Fatty acid d. Bile salts

Q50. Pancreatic juice rich in water and electrolytes but poor in enzymes is secreted in response to :

a. Pancreozymin b. Cholecystokinin
c. Secretin d. Protein

35. c	36. d	37. d	38. b	39. d	40. a	41. c	42. b	43. a	44. b
45. b	46. b	47. d	48. a, b	49. a	50. c				

Q51. Cephalic phase of gastric secretion is mediated by :

a. Neurohormones
b. Parasympathetic nervous sytem
c. Sympathetic nervous system
d. Gastrin

Q52. Most potent stimulus for secretin is :

a. Dilatation of intestine
b. Acidic chyme
c. Protein
d. Fat

Q53. Which of the following is absorbed in the colon :

a. Iron
b. Protein
c. Bile salts
d. Electolytes

Q54. Which of the following is absorbed in the proximal intestine :

a. Iron
b. Electrolytes
c. Bile salts
d. Fat

Q55. Best stimuli for CCK secretion is:

a. Acid
b. Protein
c. bile
d. Fat

Q56. Pepsinogen is activated by :

a. Enterokinase
b. Low p H
c. Trysin
d. Chymotrypsin

Q57. The duodenum secretes a hormone which has the following effects except :

a. Causes copious pancreatic juice rich in bicarbonate and poor in enzyme
b. Increases gastric motility
c. Causes gall bladder to contract and sphincter of Oddi to relax
d. Leads to meagre flow of pancreatic juice rich in enzyme

Q58. The final sugars in intestinal chyme are :

a. Glucose & fructose
b. Ribose & mannose
c. Ribose &xylulose
d. Xylulose& fructose

Q59. All of the following are secreted in the proenzyme form except :

a. Trypsin
b. Chymotrypsin
c. Pepsin
d. Ribonuclease

Q60. Fat is maximally absorbed in :

a. Ileum
b. Colon
c. Stomach
d. Jejunum

Q61. Which inhibits gastrin secretion :

a. Secretin
b. High gastric pH
c. Insulin
d. Calcium

Q62. Maximum contraction of gall bladder is seen with :

a. CCK
b. Secretin
c. Gastrin
d, Enterogastrone

Q63. Chyme is propulsed forward in small intestine by :

a. Segmentation
b. Haustrations
c. Migratory motor complexes (MMC)
d. Peristalsis

Q64. Longest transit time in GIT is seen in:

a. Stomach
b. Jejunum
c. colon
d. Ileum

Q65. Mixing waves in stomach :

a. Originate in body of stomach
b. Originate in fundus of stomach
c. Originate in incisuraangularis
d. Originate in any part of stomach

Q66. Bile acids are synthesized from :

a. Cholesterol
b. Amino aicds
c. Bilerubin
d. Protein

Q67. Which of the following inhibits gastric secretion and motility :

a. Vasoactive intestinal poly peptide (VIP)
b. Gastric inhibitory peptide (GIP)
c. Somatostatin
d. Ghrelin

Q68. The mechanism involved in the absorption of glucose from the small intestine is:

a. Passive diffusion
b. Facilitated diffusion
c. Secondary active co-transport with sodium
d. Actively by insulin dependent uptake

51. b	52. b	53. d	54. a	55. b	56. b	57. b	58. a	59. d	60. d
61. a	62. a	63. d	64. c	65. b	66. a	67. c	68. c		

Q69. Which of the following is produced by the stomach and has a role in control of food intake :

a. Ghrelin
b. Insulin Iike growth factor-1
c. Orexin
d. Cholecystokinin

Q70. Secretion of bile into bile canaliculus is by :

a. Osmotic gradient
b. Facilitated diffusion
c. Active transport across the membrane
d. Simple diffusion

Q71. Trypsinogen is converted to trypsin by :

a. Pepsin b. Enterokinase
c. HCI d. None

Q72. Resection of which intestinal segment causes marked electrolyte imbalance :

a. Duodenum b. Jejunum
c. Ileum d. Sigmoid

Q73. Cephalic phase of gastric secretion :

a. 20% b. 70%
c. 10% d. 100%

Q74. Which vitamins are synthesized by intestinal bacteria :

a. Vit K and D b. Vit K and B
c. Vit A and D d. Vit K and C

Q75. Role of bile salts is:

a. Vit B 12 absorption
b. Formation of lipid bilayer
c. Emulsification of lipids
d. Fatty acid degradation

Q76. Gastric secretion in increased by all except :

a. Histamine b. Acetylcholine
c. Gastrin d. HCI

Q77. HCI secretion in gastric phase is increased by :

a. Pepsinogen b. CCK
c. Gastrin d. HCI

Q78. I cells in the small intestine secrete:

a. Secretin b. Gastrin
c. CCK d. Motilin

Q79. Pepisinogen is secreted by :

a. Parietal cells b. Mucus cell
c. Chief cells d. Oxyntic cells

Q80. Gastric secretions are essential for absorption of :

a. Cobalamin b. Fat
c. Thiamine d. Protein

Q81. Major initiating response for peristalsis is :

a. Hormonal
b. Local stretching of gut
c. Neural
d. None

Q82. A man cannot digest carbohydrate . The enzyme deficient is :

a. Lipase b. Amylase
c. Pepsin d. Trypsin

Q83. Best absorbable monosaccharide :

a. Glucose b. Mannose
c. Fructose d. lactose

Q84. What is responsible for clearing & flushing food from the intestinal lumen in the interdigestive period :

a. Gastrin
b. Migrating motor complexes
c. Secretin
d. CCK

Q85. Which enzyme is not released as a proenzyme :

a. Pepsin b. Amylase
c. Trypsin d. Chymotrypsin

Q86. Cephalic phase of gastric secretion occurs:

a. On food entering stomach
b. On food entering intestine
c. On seeing food
d. On stress

Q87. Ghrelin is responsible for :

a. Stimulation of appetite
b. suppression of appetite
c. stimulation of sleep
d. Suppression of sleep

69. d	70. c	71. b	72. b	73. a	74. b	75. c	76. d	77. c	78. c
79. c	80. a	81. b	82. b	83. a	84. b	85. b	86. c	87. a	

Q88. Entero hepatic circulation is necessary for the secretion of :

a. Bile
b. Internal juice
c. Pancreatic juice
d. Gastric juice

Q89. Diasaccharides are digested mostly in :

a. Oral cavity
b. Stomach
c. Small intestine
d. Large intestine

Q90. Tone of lower esophageal sphincter is increased by :

a. Acetyl choline
b. VIP
c. Nitrous oxide
d. Wave of primary peristalsis

Q91. Alcohol is maximally absorbed in:

a. Stomach b. Duodenum
c. Jujenum d. Colon

Q92. Maximum gastric secretion occurs in:

a. cephalic phase
b. Intestinal phase
c. Gastric phase
d. None

Q93. Submucosal plexus of GIT is:

a. Myenteric plexus
b. Auerback's plexus
c. Meissner's plexus
d. Extrinsic nerves

Q94. "Delta cells " of stomach secrete:

a. Cholecystokinin
b. Gastrin releasing peptide
c. somatostatin
d. Secetin

Q95. Following enzymes are found in lysosomes except :

a. Arylsulfatases
b. Ribonucleases
c. Glycosidases
d. Lipase

Q96. All have significant role in digestion of fat except :

a. Pancreatic lipase
b. Colipase
c. Lingual lipase
d. Bile salts

Q97. Lingual lipase is secreted by :

a. Parotid gland
b. Ebner's gland
c. Sublingual glands
d. None

Q98. All of the following GIT hormones belong to secretin family except :

a. Secretin b. Glucagon
c. CCK d. VIP

Q99. All are component of bile except :

a. Bile salts
b. Bile pigment
c. Stercobilinogen
d. Bilirubin

Q100. Gastric emptying is delayed by all except :

a. Fat in duodenum
b. Acid in duodenum
c. Gastrin
d. Secretin

Q101. Which of the following Hydro-choleretic :

a. CCK b. Secretin
c. Fatty acid d. Amino acids

Q102. Lowest pH is seen in which of the following gastrointestinal secretion:

a. Gastric juice b. Bile juice
c. Saliva d. Pancreatic juice

Q103. Daily salivary secretion is :

a. 250 500 ml
b. 1000- 1500 ml
c. 2000-2500 ml
d. 3000 ml

Q104. Pacemaker cells of the GIT are located in:

a. Esophagus b. Stomach
c. Duodenum d. Jejunum

88. a	89. c	90. a	91. c	92. c	93. c	94. c	95. d	96. c	97. b
98. c	99. c	100. c	101. b	102. a	103. b	104. b			

Q105. Inhibition of myenteric plexus results in :

a. Hyperacidity
b. Diarrhea
c. Decreased gut motility
d. Increased secretions

Q106. Blood supply of liver in ml/ min is :

a. 500 b. 1500
c. 3000 d. 5000

Q107. Most important hormone for gall bladder contraction to release bile:

a. Secretin b. VIP
c. GIP d. CCK

Q108. Compared to milk, colostrum contains more of all of the following except :

a. Ca b. Na
c. K d. Cl

Q109. Colostrum contains all in excess of milk accept :

a. Protein b. Fat
c. Mineral d. Immunoglobulins

Q110. Human colostrum has a relatively higher concentration of all of the following except :

a. Protein b. Fat
c. IgA d. Sodium

105. c	106. b	107. d	108. a	109. c	110. d

Gastrointestinal Tract – Explanations

1. **c) Hexoses**

(Ref. Ganong's Physiology 25th edition, page 478).

Explanation- Hexoses are rapidly absorbed across the wall of the small intestine. Poly, oligo and disaccharides must be digested to monosaccharides prior to absorption.

2. **d) Pepsinogen**

(Ref. Ganong's Physiology 25th edition, Table 25.1, page 457).

3. **b) Gamma globulin**

(Ref. Guyton' Physiology 13th edition, page 469).

Explanation- The mature plasma cell then produces gamma globulin antibodies at an extremely rapid rate—about 2000 molecules per second for each plasma cell. In turn, the antibodies are secreted into the lymph and carried to the circulating blood.

4. **d) All of the above**

(Ref. Ganong's Physiology 25th edition, Table 25.6, page 470).

Explanation- Gastrin secretion is affected by the contents of the stomach, the rate of discharge of the vagus nerves, and bloodborne factors (Table 25–6).

5. **a) Trypsin**

(Ref. Ganong's Physiology 25th edition, Table 25.2, page 461).

6. **e) Bile salt**

(Ref. Human Physiology: From Cells to Systems by Lauralee Sherwood 8th edition, pp 413 Ganong's Physiology 13th edition, pp 513).

Explanation- Bile salts are the most potent stimulus for bile secretion.

Substances that increase the secretion of bile are known as choleretics. Bile acids themselves are among the most important physiologic choleretics.

7. **d) Gastric secretion increase.**

(Ref. Ganong's Physiology 25th edition, page 470).

Explanation- Secretin increases the secretion of bicarbonate by the duct cells of the pancreas and biliary tract. Inhibits gastric emptying by contracting pyloric sphincter. It is an inhibitor of gastric secretion.

8. **d) Jejunum**

(Ref. Ganong's Physiology 25th edition, page 483).

Explanation- Absorption of long-chain fatty acids is greatest in the upper parts of the small intestine, but appreciable amounts are also absorbed in the ileum. On a moderate fat intake, 95% or more of the ingested fat is absorbed.

9. **c) Increased by stomach distention**

(Ref. Ganong's Physiology 25th edition, Table 25.6, page 470).

10. **c) Ileum**

(Ref. Ganong's Physiology 25th edition, Table 26.1, page 477).

11. **b) Meissner's piexus**

(Ref. Guyton's Physiology 13th edition, page 799).

Explanation- The myenteric plexus controls mainly the gastrointestinal movements, and the submucosal plexus controls mainly gastrointestinal secretion and blood flow.

12.

(Ref. Ganong's Physiology 25th edition, page 470).

Explanation- CCK inhibits gastric emptying and augments the contraction of pyloric sphincter.

Cholecystokinin is a negative regulator of gastric acid secretion and postprandial release of gastrin in humans. Ref. Gastroenterology 1994; 107:1610-20.

CCK transiently relaxes lower esophaegeal sphincter in response to gastric distension. Ref. Gut 1997;40:575-581.

13. d) Stimulates gastric emptying

(Ref. Ganong's Physiology 25th edition, page 470).

Explanation- CCK inhibits gastric emptying and augments the contraction of pyloric sphincter.

14. c) Gastrin

(Ref. Guyton's Physiology 13th edition, page 451).

Stimulates gastric emptying- Gastrin.

Inhibits gastric emptying- CCK, Gastrin and Gastric Inhibitory Peptide(GIP).

15. d) Hormones

(Ref. Guyton's Physiology 13th edition, page 451).

Explanation- The enterogastric inhibitory reflexes are especially sensitive to the presence of irritants and acids in the duodenal chyme. Breakdown products of protein digestion also elicit inhibitory enterogastric reflexes. Finally, either hypotonic or hypertonic fluids especially hypertonic and distension of duodenum also elicit inhibitory reflexes. Hormones also control gastric motility but not via enterogastric reflexes.

16. b) Colon

(Ref. Ganong 's Physiology 25th edition, page 483).

Explanation- Short chai fatty acids are 2-5 carbon weak acids that are produced and absorbed in colon.

17. d) Chymotrypsin

(Ref. Ganong 's Physiology 25th edition, page 470).

18. a) Bile pigments

(Ref. Ganong 's Physiology 25th edition, Fig. 26.6,page 482).

19. c) Histamine

(Ref. Ganong 's Physiology 25th edition, page 470).

20. a) CCK

(Ref. Guyton's Physiology 13th edition, page 421).

Explanation- By far the most potent stimulus for causing gall bladder contraction is CCK.

21. a) Increased gall-bladder contraction and HCO_3 rich pancreatic fluid

(Ref. Ganong 's Physiology 25th edition, page 470).

Explanation- Secretin increases the secretion of bicarbonate by the duct cells of the pancreas and biliary tract.

22. b) Antrum

(Ref. Ganong 's Physiology 25th edition, page 467).

23. c) Parietal or oxyntic cells

(Ref. Guyton's Physiology 12th edition, page 820, 13th pp 406).

Explanation- Normal gastric secretions contain a glycoprotein called intrinsic factor, secreted by the same parietal cells that secrete hydrochloric acid.

24. d) Cl

(Ref. Guyton's Physiology 12th edition, page 809, 13th pp. 407).

Explanation- Salivary alpha amylase is activated by chloride ions. It has an optimal pH of 6.7 and its action is inhibited by the acidic gastric juice when food enters the stomach.

25. d) Destruction of auerbach's plexus

(Ref. Guyton's Physiology 12th edition, page 786, 13th pp. 450).

26. d) Occurs at a rate of 5 cms per second from the stomach.

(Ref. Ganong's Physiology 25th edition, page 496).

Explanation- MMC: Occurs during fasting between periods of digestion. It initiates in stomach, moves with the speed of 5 cm/min.

27. b) Pancreatic juice

(Ref. Fluid and Electrolyte balance; by

Norma Metheny and Harrison's Principle of Internal Medicine 19th Table 98 e-2).

28. c) Estrogen

(Ref. Ganong's Physiology 25th edition, page 510).

Explanation- In this regard, in addition to disposing of drugs, the liver is responsible for metabolism of essentially all steroid hormones. Liver disease can therefore result in the apparent overactivity of the relevant hormone systems.

29. b) Amphipathic lipids in water

(Ref. Ganong's Physiology 25th edition, page 513).

Explanation- Phosphatidylcholine that enters the bile forms mixed micelles with the bile acids and cholesterol.

30. b) K^+

(Ref. Guyton's Physiology 12th edition, page 796, 13th, pp 409).

Explanation- The hydrogen ions are then actively secreted in exchange for K+ ions, this active exchange process is catalyzed by H+K+ ATP ase.

31. a) Cholesterol

(Ref. Ganong's Physiology 25th edition, page 513).

32. b) Duodenum and proximal jejunum

(Ref. Ganong's Physiology 25th edition, page 483).

33. a) Phagocytic

(Ref. Ganong's Physiology 25th edition, page 508).

Explanation- Numerous macrophages (Kupffer cells) are anchored to the endothelium of the sinusoids and project into the lumen.

34. a) Na^+

(Ref. Ganong's Physiology 25th edition, page 478).

Explanation- SGLT-1 is responsible for uptake of dietary glucose from the gut, which is a co- transporter system.

35. c) Somatostatin

(Ref. Ganong's Physiology 25th edition, page 471).

Explanation- Somatostatin inhibits the secretion of gastrin, VIP, GIP, secretin, and motilin. Its secretion is stimulated by acid in the lumen, and it probably acts in a paracrine fashion to mediate the inhibition of gastrin secretion produced by acid. It also inhibits pancreatic exocrine secretion; gastric acid secretion and motility; gallbladder contraction; and the absorption of glucose, amino acids, and triglycerides.

36. d) Carboxy peptidases.

(Ref. Ganong's Physiology 25th edition, page 480).

Explanation- The carboxypeptidases of the pancreas are exopeptidases that hydrolyze the amino acids at the carboxyl ends of the polypeptides.

37. d) Gastrocolic – reflex

(Ref. Guyton's Physiology 12th edition, page 786, 13th pp 450).

Explanation- Appearance of mass movements after meals is facilitated by gastrocolic and duodenocolic reflexes. Mass movement is more prominent in infants leading to defecation following meals.

38. b) Duoderum/ileum

(Ref. Ganong's Physiology 25th edition, page 471).

Explanation- Motilin is secreted by enterochromaffin cells and Mo cells in stomach, small intestine and colon. Maximum in duodenum- jejunum.

39. d) Sigmoid colon

Sigmoid colon >> Transverse colon. (Ref. Yamada Gastroenterology 5th pp 244).

Explanation- Eating elicits motor activity throughout the colon. Greater in the sigmoid than in the transverse colon, this increased activity is termed the gastro-colonic response.

40. a) Saliva

(Ref. Fluid and electrolyte balance; by Norma Metheny and Harrison's Principles of Internal Medicine 19th Table 98e-2).

Explanation- Highest secretion- saliva.

Highest concentration- colon- rectum.

41. c) Secondary active cotransport with sodium

(Ref. Ganong's Physiology 25th edition, page 478).

42. b) Is regulated in part by number of H^+ pumps

(Ref. Ganong's Physiology 25th edition, Fig. 25.6- page 458).

43. a) Colonic secretions

(Ref. Fluid and electrolyte balance; by Norma Metheny and Harrison's Principles of Internal Medicine 19th Table 98e-2).

Explanation- Highest secretion- saliva.

Highest concentration- colon- rectum

44. b) Jejunum

(Ref. Ganong's Physiology 25th edition, Table- 25.4, page 464).

45. b) Parotid gland

(Ref. Ganong's Physiology 25th edition, Fig. 25.6- page 455).

46. b) 5 cm/ min every 90 minutes

(Ref. Ganong's Physiology 25th edition, Fig. 25.6- page 496).

Explanation- MMCs occur every 90 mins and at rate of 5cm/min.

47. d) Abdominal muscles

48. a) Trypsin

b) Lipase

(Ref. Ganong's Physiology 25th edition, page 461).

49. a) Trypsin

(Ref. Ganong's Physiology 25th edition, Table 25.2, page 461).

50. c) Secretin

(Ref. Ganong's Physiology 25th edition, Table 25.2, page 461).

51. b) Parasympathetic nervous sytem

(Ref. Guyton's Physiology 12th edition, pp 798, 13th pp 411).

Explanation- The cephalic phase of gastric secretion occurs even before food enters the stomach and is mediated via parasympathetic (vagal) discharge , so not seen during stress.

52. b) Acidic chyme

(Ref. Ganong's Physiology 25th edition, page 471).

Explanation- The secretion of secretin is increased by the products of protein digestion and by acid bathing the mucosa of the upper small intestine. The release of secretin by acid is another example of feedback control: Secretin causes alkaline pancreatic juice to flood into the duodenum, neutralizing the acid from the stomach and thus inhibiting further secretion of the hormone.

53. d) Electolytes

(Ref. Raff's Medical Physiology A Systems Approach, 2011, pp 528).

Explanation- Amongst the options provided, electrolytes are absorbed in colon.

54. a) Iron

(Ref. Ganong's Physiology 25th edition, page 483).

Explanation- Almost all the iron absorption occurs in duodenum and small amount in proximal jejeunum.

55. b) Protein

(Ref. Ganong's Physiology 25th edition, page 470).

Explanation- The secretion of CCK is increased by contact of the intestinal mucosa with the products of digestion, particularly peptides and amino acids, and also by the presence in the duodenum of fatty acids containing more than 10 carbon atoms. There are also two protein releasing factors that activate CCK secretion, known as CCK-releasing peptide and monitor peptide, which derive from the intestinal mucosa and pancreas, respectively.

56. b) Low p H

(Ref. Ganong's Physiology 25th edition, page 479).

Explanation- Like many of the other enzymes concerned with protein digestion, pepsins are secreted in the form of inactive precursors (proenzymes)

and activated in the gastrointestinal tract. The pepsin precursors are called pepsinogens and are activated by gastric acid.

57. b) Increases gastric motility

(Ref. Ganong's Physiology 25th edition, page 470).

Explanation- CCK inhibits the gastric emptying and augments the contraction of pyloric sphincter.

58. a) Glucose & fructose

(Ref. Ganong's Physiology 25th edition, page 476).

Explanation- Sucrase hydrolyzes sucrose into a molecule of glucose and a molecule of fructose. In addition, lactase hydrolyzes lactose to glucose and galactose.

59. d) Ribonuclease

(Ref. Ganong's Physiology 25th edition, page 461).

60. d) Jejunum

(Ref. Ganong's Physiology 25th edition, page 477).

61. a) Secretin

(Ref. Guyton's Physiology 12th edition, page 798, 13th pp 410).

Explanation- Gastric acid is a inhibitor of further acid secretion.

Calcium stimulates gastrin release.

62. a) CCK

(Ref. Ganong's Physiology 25th edition, page 470).

Explanation- CCK inhibits the gastric emptying and augments the contraction of pyloric sphincter.

63. d) Peristalsis

(Ref. Ganong's Physiology 25th edition, page 496).

Explanation- Peristalsis and mass movement are propulsive

movements. Segmentation and haustrations are non propulsive movement. MMC is a fasting movement, not for propulsion of chyme.

64. c) colon

(Ref. Jhonson's Essential Medical Physiology,3rd edition, pp 488).

Explanation- Longest transit time colon – 20 hrs. Transit time- esophagus- 4-8 sec, stomach: 2-5 hrs and small intestine – 3-6 hrs.

65. b) Originate in fundus of stomach

(Ref. Guyton's Physiology, 13th edition, pp 810).

Explanation- As long as food is in the stomach, weak peristaltic constrictor waves, called mixing waves, begin in the mid to upper portions of the stomach wall and move toward the antrum

about once every 15 to 20 seconds.

66. a) Cholesterol

67. c) Somatostatin

(Ref. Ganong's Physiology 25th edition, page 471).

Explanation- Somatostatin inhibits the secretion of gastrin, VIP, GIP, secretin, and motilin. Its secretion is stimulated by acid in the lumen, and it probably acts in a paracrine fashion to mediate the inhibition of gastrin secretion produced by acid. It also inhibits pancreatic exocrine secretion; gastric acid secretion and motility; gallbladder contraction; and the absorption of glucose, amino acids, and triglycerides

68. c) Secondary active co-transport with sodium

(Ref. Ganong's Physiology 25th edition, page 478).

Explanation- SGLT-1 is responsible for uptake of dietary glucose from the gut, which is a co- transporter system.

69. d) Cholecystokinin

(Ref. Ganong's Physiology 25th edition, page 470).

Explanation- CCK is found in nerves in the distal ileum and colon. It is also found in neurons in the brain, especially the cerebral cortex, and in nerves in many parts of the body (see Chapter 7). In the brain, it may be involved in the regulation of food intake, and it appears to be related to the production of anxiety and analgesia.

70. c) Active transport across the membrane

(Ref. Ganong's Physiology 25th edition, page 513).

Explanation- The secretion of bile is the result of active secretion of osmotically active compounds by hepatocytes into the canalicular space followed by the passive movement of water through the tight junctions.

71. b) Enterokinase

(Ref. Ganong's Physiology 25th edition, page 479).

72. b) Jejunum

(Ref. Raff's Medical Physiology A Systems Approach, 2011, page 528).

Explanation- Most of the fluid and electrolytes absorption occurs in jejunum.

73. a) 20%

(Ref. Guyton's Physiology 12th edition, page 820, 13th pp 410).

Ans- The stimulation of acid secretion is divided into cephalic(20-30%), gastric (60-70%) and intestinal(10%).

74. b) Vit K and B

(Ref. Lancet 2003;361:512-19).

Explanation- Functions of colonic bacteria- Fermentation of nondigestible dietary residue and endogenous mucus. Production of short chain fatty acids and Vit K & B. Absorption of ions. Increase in epithelial cell proliferation(trophic effect) and differentiation.

75. c) Emulsification of lipids

(Ref. Ganong's Physiology 25th edition, page 463).

Explanation- The bile acids have a number of important actions: they reduce surface tension and, in conjunction with phospholipids and monoglycerides, are responsible for the emulsification of fat preparatory to its digestion and absorption in the small intestine (see Chapter 26). They

76. d) HCI

(Ref. Guyton's Physiology 12th edition, page 798, 13th pp 410).

Explanatioin- Gastric acid is a inhibitor of further acid secretion.

77. c) Gastrin

(Ref. Guyton's Physiology 12th edition, page 798, 13th pp 411).

Explanation- The stimuli for gastric phase of acid secretion are : local nervous reflexes,vagal reflexes, gastrin-histamine stimulation.

78. c) CCK

(Ref. Ganong's Physiology 25th edition, page 463).

79. c) Chief cells

(Ref. Ganong's Physiology 25th edition, page 456).

Explanation- In the body of the stomach, including the fundus, the glands also contain parietal (oxyntic) cells, which secrete hydrochloric acid and intrinsic factor, and chief (zymogen, peptic) cells, which secrete pepsinogens.

80. a) Cobalamin

(Ref. Ganong's Physiology 25th edition, page 457).

Explanation- The parietal cells secrete intrinsic factor and hydrochloric acid. Intrinsic factor is essential for the absorption of Vit B12 or cobalamin.

81. b) Local stretching of gut

(Ref. Ganong's Physiology 25th edition, page 495).

Explanation- Peristalsis is a reflex response that is initiated when the gut wall is stretched by the contents of the lumen, and it occurs in all parts of the gastrointestinal tract from the esophagus to the rectum.

82. b) Amylase

(Ref. Ganong's Physiology 25th edition, page 476).

Explanation- In the small intestine, both the salivary and the pancreatic α-amylase also act on the ingested polysaccharides.

83. a) Glucose

(Ref. The Good Gut: By J Sonnenburg, E

Sonnenberg).

Explanation- Glucose is the fastest and best absorbing sugar from intestine

84. b) Migrating motor complexes

(Ref. Ganong's Physiology 25th edition, page 497).

Explanation- MMC likely serve to clear the stomach and small intestine of luminal contents in preparation for the next meal. Thus they perform housekeeping functions.

85. b) Amylase

(Ref. Ganong's Physiology 25th edition, Table 25.2, page 461)

86. c) On seeing food

(Ref. Guyton's Physiology 13th edition, page 823)

Explanation-Cephalic Phase. The cephalic phase of gastric secretion occurs even before food enters the stomach, especially while it is being eaten. It results from the sight, smell, thought, or taste of food, and the greater the appetite, the more intense is the stimulation.

87. a) Stimulation of appetite

(Ref. Guyton's Physiology 13th edition, page 892).

Explanation- Ghrelin is an orexigenic signal (appetite stimulant) for the hypothalamus.

88. a) Bile

(Ref. Ganong's Physiology 25th edition, page 462).

Explanation- Some of the components of the bile are reabsorbed in the intestine and then excreted again by the liver (enterohepatic circulation).

89. c) Small intestine

(Ref. Ganong's Physiology 25th edition, page 477).

Explanation- Hexoses are rapidly absorbed across the wall of the small intestine (Table 26–1). Essentially all the hexoses are removed before the remains of a meal reach the terminal part of the ileum.

90. a) Acetyl choline

(Ref. Guyton's Physiology 13th edition, page 808).

91. c) Jujenum

Explanation – Maximum water absorption occurs in jejunum and also alcohol is absorbed here maximally.

92. c) Gastric phase

(Ref. Guyton's Physiology 12th edition, pp 820 13th edition, page 410).

Explanation- The stimulation of acid secretion is divided into cephalic(20%), gastric (60-70%) and intestinal (10%).

93. c) Meissner's plexus

(Ref. Ganong's Physiology 25th edition, page 472).

Explanation- Two major networks of nerve fibers are intrinsic to the gastrointestinal tract: the myenteric plexus (Auerbach plexus), between the outer longitudinal and middle circular muscle layers, and the submucous plexus (Meissner plexus), between the middle circular layer and the mucosa

94. c) somatostatin

(Ref. Ganong's Physiology 25th edition, page 430).

Explanation- The D cells secrete somatostatin.

95. d) Lipase

(Ref. Ganong's Physiology 25th edition, Table 2.1, page 37).

96. c) Lingual lipase

(Ref. Ganong's Physiology 25th edition, page 481).

Explanation- A lingual lipase is secreted by Ebner glands on the dorsal surface of the tongue in some species, and the stomach also secretes a lipase (Table 26–1). They are of little quantitative significance for lipid digestion other than in the setting of pancreatic insufficiency, but they may generate free fatty acids that signal to most distal parts of the gastrointestinal tract.

97. b) Ebner's gland

(Ref. Ganong's Physiology 25th edition, page 481).

Explanation- A lingual lipase is secreted

by Ebner glands on the dorsal surface of the tongue in some species, and the stomach also secretes a lipase (Table 26–1).

98. c) CCK

(Ref. Ganong's Physiology 25th edition, page 470).
Explanation- The structure of secretin (Table 25–5) is different from that of CCK and gastrin, but very similar to that of GIP, glucagon, and VIP. Only one form of secretin has been isolated, and any fragments of the molecule that have been tested to date are inactive.

99. c) Stercobilinogen

(Ref. Ganong's Physiology 25th edition, Table 28-2, page 511).

100. c) Gastrin

(Ref. Ganong's Physiology 25th edition, page 468).
Explanation- In large doses, gastrin has a variety of actions, but its principal physiologic actions are stimulation of gastric acid and pepsin secretion and stimulation of the growth of the mucosa of the stomach and small and large intestines (trophic action).

101. b) Secretin

(Ref. Ganong's Physiology 25th edition, page 513).
Explanation- The production of bile is increased by stimulation of the vagus nerves and by the hormone secretin, which increases the water and HCO 3- content of bile.

102. a) Gastric juice

(Ref. Ganong's Physiology 25th edition, Table 39.1, page 714).

103. b) 1000- 1500 ml

(Ref. Ganong's Physiology 25th edition, page 455).
Explanation- Overall, the three pairs of salivary glands that drain into the mouth supply 1000–1500 mL of saliva per day.

104. b) Stomach

(Ref. Ganong's Physiology 25th edition, page 496).
Explanation- Pacemaker cells start appearing from mid portion of stomach and present throughout small and large intestine.

105. c) Decreased gut motility

(Ref. Guyton's Physiology 12th edition, pp 786, 13th edition, page 450).
Explanation- Motility is controlled by myenteric plexus or Auerbach plexus. So, destruction will lead to abolition of motility.

106. b) 1500

(Ref. Ganong's Physiology 25th edition, page 473).
Explanation- The viscera and the liver receive about 30% of the cardiac output via the celiac, superior mesenteric, and inferior mesenteric arteries. The liver receives about 1300 mL/min from the portal vein and 500 mL/min from the hepatic artery during fasting, and the portal supply increases still further after meals.

107. d) CCK

(Ref. Ganong's Physiology 25th edition, page 470).

108. a. Ca

109. c) Mineral

(Ref. Ganong's Physiology 25th edition, Table 22-6, page 414).

110. d) Sodium

(Ref. Ganong's Physiology 25th edition, Table 22-6, page 414).